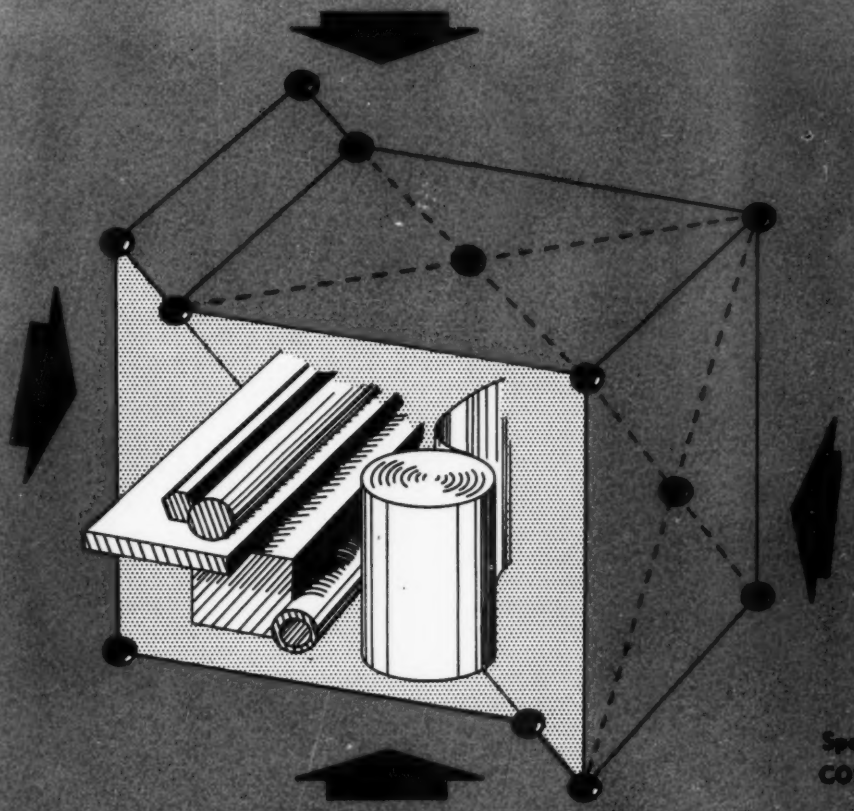
TOOLING & PRODUCTION

Magazine

OCTOBER 1957



Special Report on COLD FORMING
. . . page 91

Ingenuity & Inspiration . . . . . C. F. Kettering **54**

Cut & Carry Techniques . . . . . E. J. Urbas **73**

Forces in Brake Forming . . . . . W. W. Wood **77**

Die Set for Steel-Rule Dies **85**

Weldment Layout Unit . . . . . H. Koslow **88**

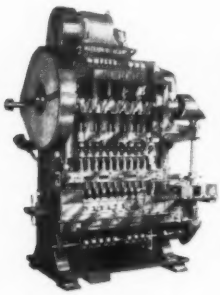
DEPARTMENTS

Commendable Comments 42
Coming Events 46
Manufacturing Memos 144
Shop Aids 146
Book Reviews 173
Helpful Literature 182
What's New in Plastics 205
Products on Parade 212
Cumulative Editorial Index 272

For **Automation** In Pressworking

THINK OF WATERBURY FARREL

"Waterbury" Transfer Presses



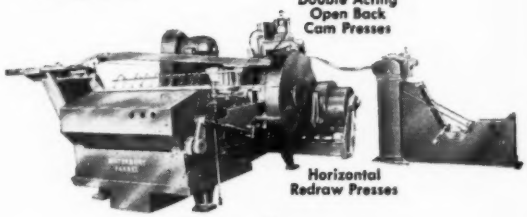
Cam and Crank Eyelet Machines

Four Post Blanking Presses

High Speed Blankers

Double Acting Open Back Cam Presses

Single Acting Open Back Bench Presses



Horizontal Redraw Presses

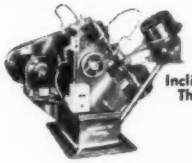
Waterbury Farrel's extraordinary range of press-building experience encompasses a wide variety of single and multiple operation presses. These include virtually every commercial type up to 600 ton capacity.

In addition, Waterbury Farrel has successfully engineered automated press output by combining presses, feeds, hoppers, straighteners, coil holders, scrap choppers, scrap winders, finger motions, attachments for side piercing, blank turning, stripper release, and blank holding mechanisms into production-team units.

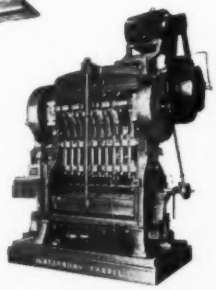
Write for free catalogs on specific types of presses or contact your nearest Waterbury Farrel office today.

THE WATERBURY FARREL FOUNDRY & MACHINE CO. **Waterbury, Conn.**

Sales Offices: Chicago • Cleveland • Millburn, N. J.



Inclined Shell Threaders



Multiple Plunger Pillar Presses

COLLAPSIBLE TUBE EQUIPMENT
Knuckle Joint Presses
Tube Cap Machinery
Tube Trimming Lathes

HIGH SPEED PRESSES
Two Post Blanking
Four Post Blanking

MULTIPLE STATION MACHINES
Cam Eyelet
Crank Eyelet
Multiple Plunger
Pillar Presses
Transfer Presses
Horizontal Redraw Presses

OPEN BACK PRESSES
Double Acting Cam
Double Acting Crank
Geared
Single Acting Crank

PILLAR PRESSES
Double Acting Cam
Double Acting Crank
Geared Pillar
Single Acting Crank

SMALL PRESSES
Foot
Hand
Safety Bench
Single Acting
Open Back Bench

SINGLE AND DOUBLE GEARED ARCH DRAWING PRESSES
THREADERS
Inclined Shell Threaders
Screw Cap Thread Rolling Machines

MINT COINING PRESSES
LATHES
Edging, Trimming and Knurling Lathes

AMMUNITION AND CARTRIDGE MACHINERY
Arbor Lathes

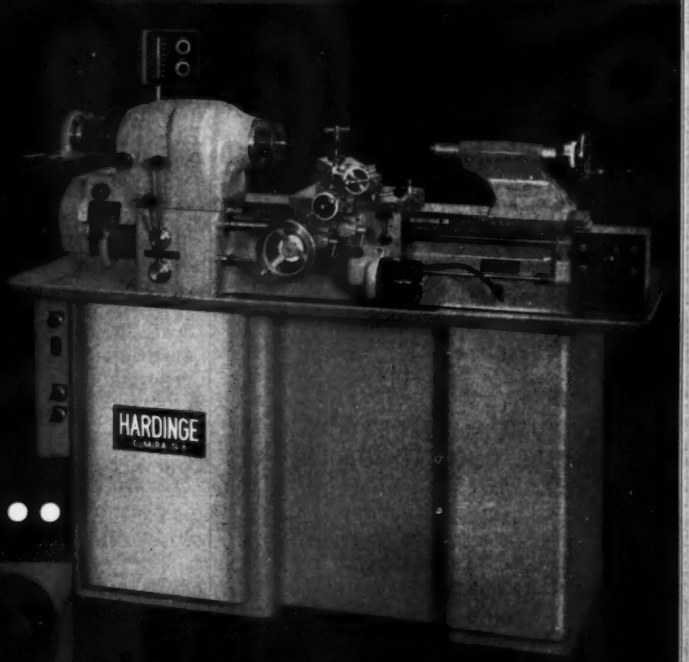
MISCELLANEOUS
Coil Holders
Coil Holders and Roll Straightener Units
Roll Straighteners
Unwinding Device
Gang Slitters

WF-34

CIRCLE INFORM-A-GRAM KEY NO. 2

HARDINGE
ELMIRA, N.Y.

EASY READING HARDINGE BLACK AND WHITE DIALS



MEAN INCREASED PRODUCTION . . .

. . . **HARDINGE** developed these fast setting easy reading **black and white dials** — they assure maximum accuracy with high production.

Pioneered with the Hardinge High Speed Precision Tool Room Lathe model HLV shown here — **Hardinge black and white dials** are now standard equipment at **no extra cost** on all of our tool room and production machines.

Invest in Hardinge equipment for product improvement and increased production. Ask for bulletin on our tool room and production machines.

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.

Special Size Reamers
ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS
Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.
14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS
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14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a complete reamer line.
See your L&I Distributor.

L&I

"the reamer specialists"
LAVALLEE & IDE, INC.
CHICOPEE, MASS.
CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

OCTOBER 1957
VOL. XXIII—No. 7
GEORGE J. HUEBNER, Founder

PERSONALLY SPEAKING

Dear T&P Reader:

Last month we referred rather briefly to some questionnaires sent out to T&P readers to obtain information concerning their job responsibilities. More than half of the readers we queried have responded. That really is terrific. Thanks much for your help.

The questionnaire was sent out by Wats Nordquist, T&P managing editor, and one of the most vital features of the study is that it suggests subjects for future articles which would be helpful to many of you. To ascertain this is a never ending quest.

Something that can be of considerable usefulness in the plants of many of you T&P readers is going to be announced soon. It is a new driving center for use in lathes and it makes possible the machining of a workpiece along its entire length. When you see this new driving center I'm sure you'll agree that it's one of those things that belongs in the "Why didn't I think of it?" department. Write me if you want more information.

There seems to be more than the usual prognosticating going on these days. You can hear almost anything you'll listen to — fabulous growth in a thousand different ways — amazing new products that are almost unimaginable. The interesting part of all this is that there's more truth in it than fiction. I heard about something new the other day that, if true, is really amazing.

It's in the category of heating and cooling and the story I got is that when electric current is passed through a bimetal unit in one direction, heat is generated. Reverse the flow and heat is absorbed and a cooling effect is produced. A nice idea if it works.

Cordially yours,

Ray Huebner

Publisher

TOOLING & PRODUCTION

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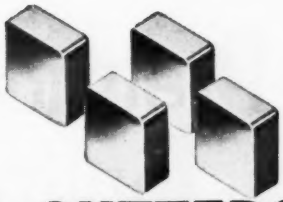
You change only the throw-away insert

. . . not the cutter body



WITH NEW V-R ALL-PURPOSE FACE MILL CUTTERS

- **Save downtime . . .**
- **Reduce lost production . . .**
- **Eliminate carbide grinding . . .**
- **Reduce carbide costs**

You get eight cutting edges with each V-R square carbide insert. Replacement and indexing takes but seconds, thanks to V-R's exclusive design. The single main screw controls the elevator which clamps the insert against the chipbreaker plate. A recessed socket in each end of the main screw makes insert replacement fast and easy, regardless of the position of the cutter. There is nothing to fall out, nothing to fumble with.

All parts are replaceable and interchangeable.

Inserts are Inexpensive . . .
Lost Production is Costly

You do not remove the cutter body when cutting edges are worn in V-R's rugged new all-purpose Face Mill Cutter. Precision ground square V-R carbide throw-away inserts index perfectly just by slipping them in position and tightening the main screw. When using a negative rake cutter, you get eight cutting edges on every insert. When the inexpensive inserts are used up, throw them away and replace with new ones.

V-R Face Mill Cutters reduce downtime, *completely eliminate carbide grinding* and save money. They are available in 4″, 6″, 8″ and 10″ standard sizes. Other sizes available to meet your requirements.

Ask for new Bulletin, call your local V-R Representative or Distributor, or write:

See the latest developments in carbide tooling at our Booth No. 1615 at the Metals Show, Chicago, November 4-8.

MANUFACTURERS OF:
CEMENTED CARBIDES, TOOLHOLDERS and TANTUNG® CAST ALLOY CUTTING TOOLS

Vascoloy-Ramet Corporation

SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

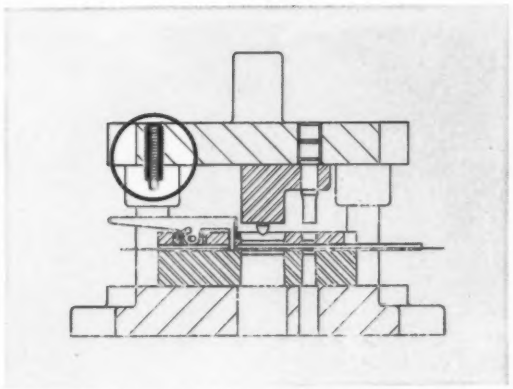
822 Market Street • Waukegan, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 5

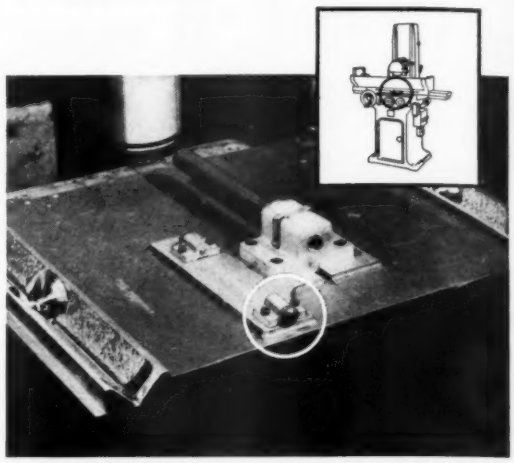
Practical Tooling Tips

Number 2 of a series.

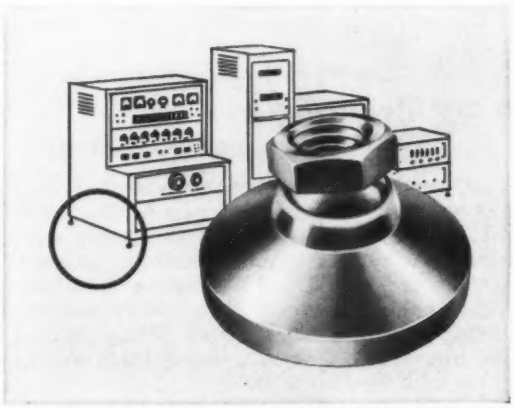
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



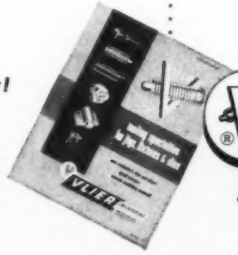
TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

New catalog now ready! Send for your copy today.



Insist on Vlier Tooling Accessories... there's still no substitute for quality!

VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 46, California

CIRCLE INFORM-A-GRAM KEY NO. 6

every **BENCO** feed finger
is tested on the stock
it is designed to feed...

therefore

BENCO *guarantees* **satisfactory operation in your machines**

BENCO PUSHERS

Benco Pushers and Feed Fingers are made of oil hardened, non-warping tool steel heat treated by precision methods. As a result each point, from the thread to the bearing area, has the proper degree of hardness while the central section is spring tensioned.

It's this combination of accurate tempering and tension that gives every Benco Pusher and Feed Finger its longer life and superior performance. Each one is rigidly inspected and tested before it leaves the plant.

Benco makes the most complete line of Feed Fingers and Master Pushers. Each provides the maximum production economies when properly used... regardless of the type or shape of stock or machine you operate. Standardize on Benco for best results.

Conventional Pusher

Squirrel Cage Pusher

Master Pusher

BENCO COLLET MANUFACTURING CO.
Cleveland 14, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 7

a hole here makes waste...

a hole here saves waste

Crucible Hollow Tool Steel cut sections eliminate the waste and cost of drilling out solid rounds to make ring-shaped or tubular steel parts, or tools with a center hole. By using these hollow bar sections, cut to length, you do away with unnecessary cutting, drilling, and boring operations, increase machine capacity, and cut scrap losses.

These hollow sections, in just about any O.D. and I.D. combination, or thickness you want, are *immediately* available in five most popular Crucible grades: KETOS oil hardening, SANDERSON water hardening, AIRDI 150 high-carbon high-chromium, AIRKOOL air hardening, and NU DIE V hot-work tool steels.

Call your nearby Crucible warehouse for more information, or for speedy delivery. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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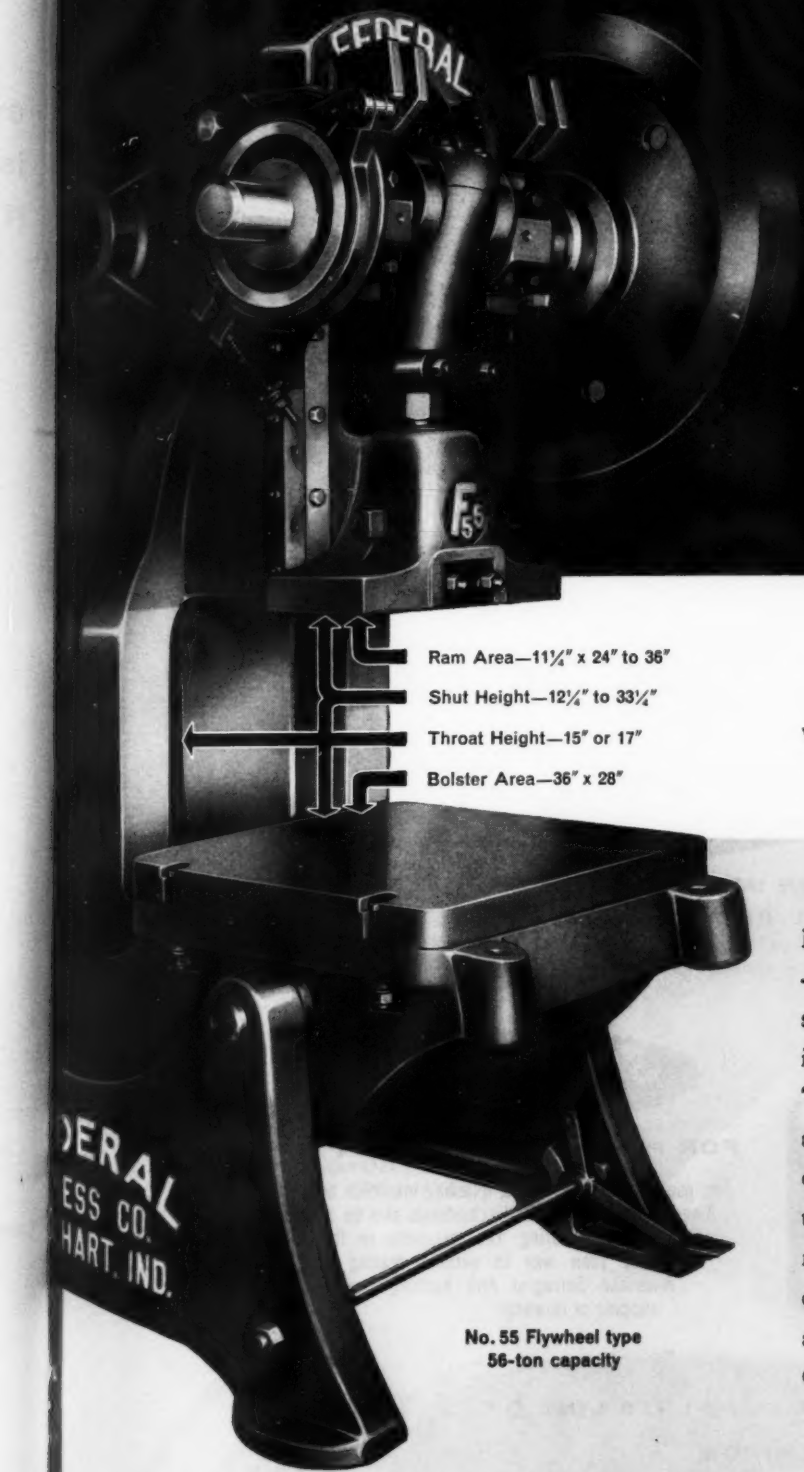
CIRCLE INFORM-A-GRAM KEY NO. 8

Introducing the new FEDERAL "55" for

JOBS... BIG and BULKY



Ram Area—11¼" x 24" to 36"
Shut Height—12¼" to 33¼"
Throat Height—15" or 17"
Bolster Area—36" x 28"

No. 55 Flywheel type
56-ton capacity

Featuring oversize dimensions, the Federal "55" handles work formerly confined to larger, more costly equipment

Here is a press born to handle bulky jobs—laminations, die-cast trimming, progressive die work and the like. Check its important dimensions and you'll see why. This rugged, precision-built FEDERAL is a great press for other reasons, too. It embodies the many *extra quality* features that have made FEDERAL PRESSES famous the world over. Available in geared or flywheel models, with mechanical or air clutch. WRITE NOW FOR NEW CATALOG showing complete line.

Federal Press Company, 707 Division Street, Elkhart, Indiana

FEDERAL *Open back Inclinable* PRESSES

32 Years of Quality Construction

NOW .... AMERICAN

*DRILL BU

DELTAGRIP
Pat. No. 2,698,547

FOR IMBEDMENT IN CASTABLE MATERIALS...

American's Deltagrip drill jig bushings can't slip or rotate in the material cast around them. They are made especially for use in castable materials such as Plastic, Cerromatrix, etc. Because of their design with the FOUR-WAY DIAMOND GRIP, Deltagrip drill bushings withstand the torque and thrust of the tool — they won't spin out.

HEXAGRIP
Pat. No. 2,728,249

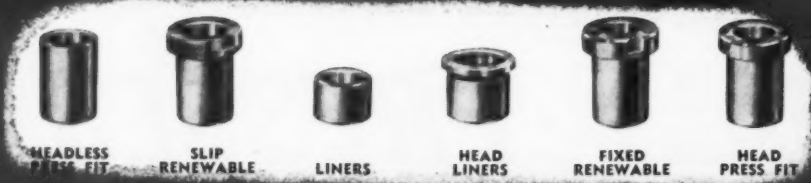
FOR IMBEDMENT IN CASTABLE MATERIALS... Also made for use in castable materials, the Hexagrip design keeps them from raising, lowering or spinning. They stay put!

SERRAGRIP
Can't Slip

FOR PRESSING INTO SOFT MATERIALS

For use in fiberglas, wood, plastic, masonite and soft metal tooling! American Serragrip drill jig bushings can be pressed into softer materials without shearing. The serrations on the drill bushings are made to ease their way in without tearing the material. Once in, the American Serragrip drill bushing's exclusive design will not permit slipping or rotating.

LOOK TO *American* FOR A COMPLETE LINE OF
DRILL JIG BUSHINGS



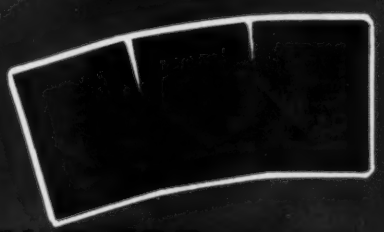
LOOK FOR THE TRADE-MARK

NOFFERS PATENTED

BUSHINGS

PLASTIC TOOLING

Save on costly
DRILL JIGS . . . use
American DELT-A-GRIP . . .
HEX-A-GRIP or SERR-A-GRIP
DRILL JIG BUSHINGS



SEND FOR FREE CATALOGS

Complete technical data and useful information on application of these drill bushings.

American

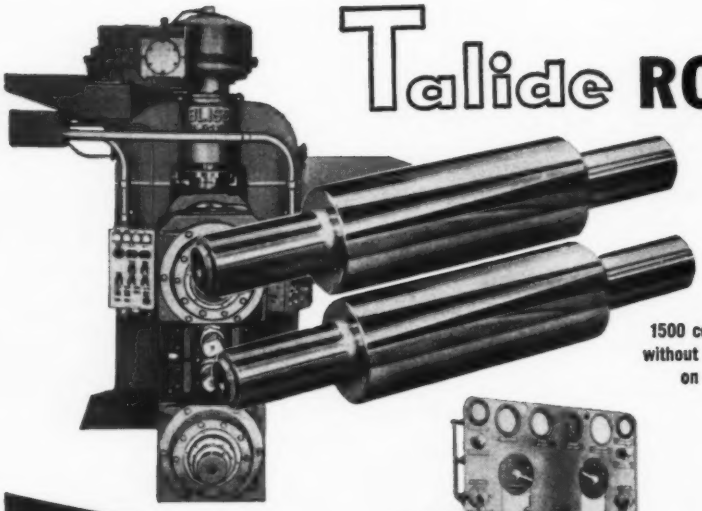
DRILL BUSHING CO.

5107 PACIFIC BLVD, • LOS ANGELES 58, CALIF.

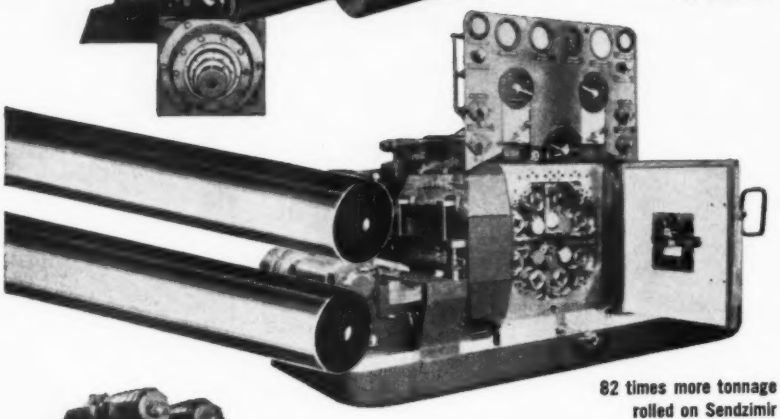
EXCLUSIVE DISTRIBUTORS LOCATED IN EVERY MAJOR AREA THROUGHOUT THE UNITED STATES

CIRCLE INFORM-A-GRAM KEY NO. 11

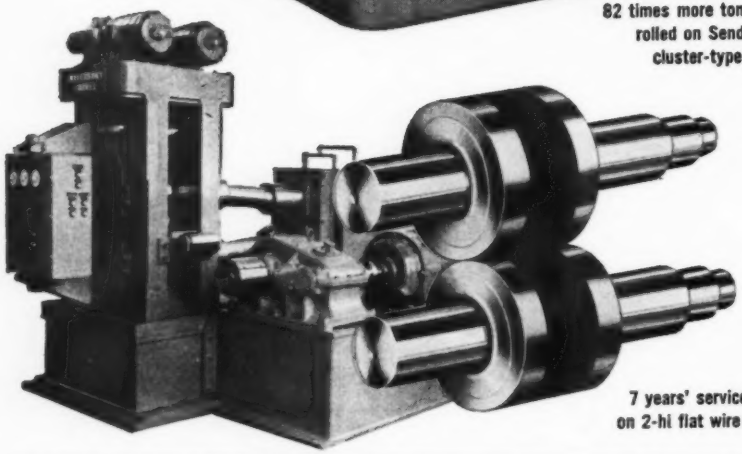
Talide ROLLS OUTLAST ALL OTHERS!



1500 coils rolled without a regrind on 4-hi mill.



82 times more tonnage rolled on Sendzimir cluster-type mill.



7 years' service life on 2-hi flat wire mill.

Talide rolls have proven far superior to both steel rolls and carbide rolls of any other make.

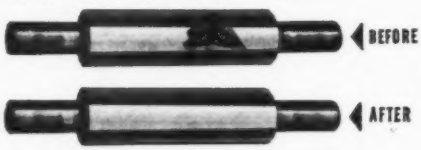
During the last five years Talide rolls have been adopted by every major strip steel producer. Metal Carbides pioneered and developed tungsten carbide rolls and successfully adapted them to all types of rolling mills including STECKEL, BLISS, UNITED, MESTA, STANAT, SENDZIMIR, WATERBURY-FARREL, TORRINGTON, RUESCH, FENN, WEAN, COLD METAL, etc.

Talide work rolls are ultra-hard, extremely dense and porous-free. Manufactured from highest purity tungsten carbide powders, the surface finish of a Talide roll is smoother than one micro-inch. Hard as a diamond, it will take a "bigger bite" than a steel roll. Strip steel of all analyses can be rolled down to thinner gauge, with more accuracy, greater reductions and with fewer anneals than possible with any other roll.

ONLY TALIDE WORK ROLLS GUARANTEE THESE ADVANTAGES

- ★ MORE PRODUCTION
- ★ BETTER FINISH
- ★ LONGER LIFE
- ★ HIGHER SPEEDS
- ★ CLOSER TOLERANCE
- ★ IMPROVED PHYSICALS
- ★ GREATER REDUCTION
- ★ LESS DOWN TIME
- ★ FEWER REJECTS
- ★ LESS MAINTENANCE

EXCLUSIVE REPAIR SERVICE



Broken or damaged carbide rolls can be re-worked to first class condition with all defects eliminated at one-half original cost. Only Metal Carbides offers this service—because of its exclusive hot press method.

Talide Rolls are made in lengths up to 100", diameters up to 25", and up to 5000 lbs. by weight.

Metal Carbides Corporation,
Youngstown 12, Ohio.

Send for new 76-page catalog 56-G

SUPERSET GRINDING WHEEL

The Superset diamond grinding wheel was specially developed for grinding carbide rolls to highest possible surface finish and luster. Made of 4-8 micron size diamond dust, it imparts a surface finish far superior to any other commercial wheel. Available in sizes up to 25" diameter

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 12

ROCKWELL-BUILT

DELTA drill presses

Delta 17" Drill Press
Delta 14" Utility Drill Press
Delta 20" Multiple Spindle Drill Press
Delta 15" Drill Press
Delta 14" Super-Hi Sensitive Drill Press

...improve production and cut costs

There are three basic reasons why Delta Drill Presses improve production and cut costs: They're VERSATILE—do the work of many expensive, single-purpose machines. They're FLEXIBLE—can be used singly or in combination—readily adapted to automated operations. They're PORTABLE—easily moved to the work to reduce materials handling, eliminate bottlenecks.

BETTER ENGINEERING—Delta—power tool pioneer—gives you quality tools built to turn out quality work. They're precision engineered for greater accuracy—hold extremely close tolerances, reduce costly rejects—even inexperienced operators turn out fine work.

RUGGED CONSTRUCTION—You get years of high standard performance under hard, continuous operation with every Delta Drill Press. They're built to last—and built to give you lower maintenance costs.

OVER 160 MODELS—Delta Drill Presses are available with: Standard or Production Table, Key Chuck or Morse Taper Spindle, High or Slow Speed, Standard or Power Feed—and in Floor, Bench or Multiple Spindle Set-Ups.

CHOOSE FROM THE WORLD'S MOST COMPLETE DRILL PRESS LINE—Get all the facts—compare—then make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages.

Send coupon for all the facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division
Rockwell Manufacturing Co.
622K N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send Delta Industrial Catalog on the complete Delta Drill Press line.

☐ Please send name of my nearest Delta Dealer.

Name_____ Title_____

Company_____

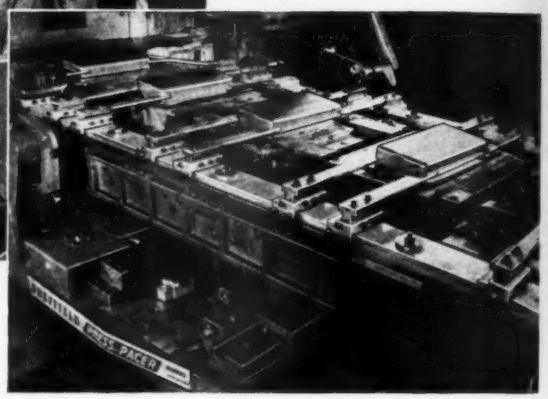
Address_____

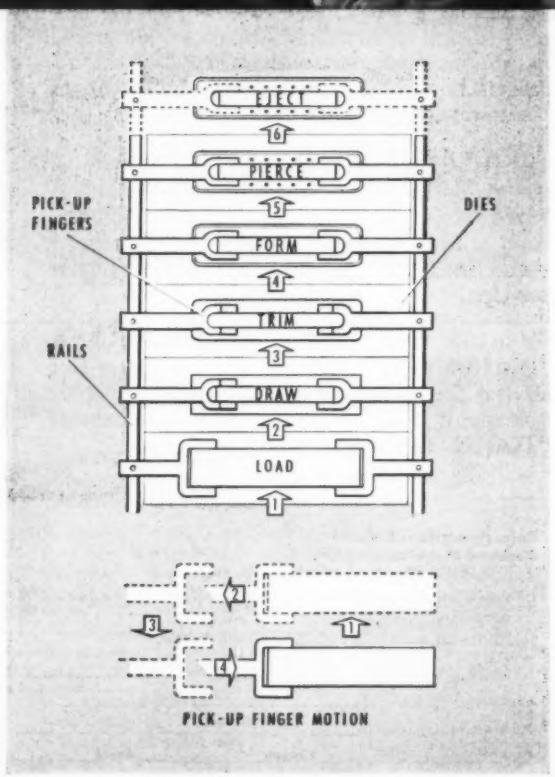
City_____ County_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 13

AUTOMATE YOUR PRESS

Automobile oil pan produced from coil stock in six operations on straight side press. Press Pacer automatically transfers stampings from each die station to the next.





The Sheffield Press Pacer is a demountable mechanical transfer device which automates the straight side press while permitting its quick reconversion to conventional operation. It moves stampings from one die position to the next with each stroke of the ram—or from one press to the next.

The Press Pacer is completely mechanical in operation. It is driven by means of a lever arm bolted to the ram. The press so equipped may be fed from front to back or from right to left—loaded and unloaded either automatically or manually.

In a typical installation the Press Pacer enabled one press to handle three times the production previously turned out by six presses. In addition it eliminated work damage caused by moving parts from press to press.

WITHOUT RESTRICTING ITS USE TO ONE PRODUCT BY MEANS OF THE

SHEFFIELD *PRESS PACER*

Press Pacer automatically moves these torque tube flange stampings through 6 die stations on this large press.

COMPLETE FLEXIBILITY

The Press Pacer can be installed in a few hours. If any emergency makes manual feeding imperative, the Press Pacer may be demounted within minutes and the press operated in conventional fashion.

The Standard Press Pacer is built for presses with a bed area of 42″ x 72″ **or larger,** and a shut height of 14″ **or more**—special units for smaller and larger presses.

Feed distance between dies for the **standard** unit may be varied between 8″ and 36″. Stroke adjustment has a range of 12″.

Feed fingers and other elements may be readily revised to accommodate product changes.

Before deciding on a change in your press equipment, find out how much a Press Pacer would save you.

Send your part prints, press information and production requirements to **The Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 20.**

*Trade-Mark

the SHEFFIELD *corporation*
measurement for mankind
of Bendix Aviation Corporation

7721R

Once around--and we'll have shipped your warehouse order for Timken® 52100 Tubing

THE hour hand on that watch goes around once in twenty-four hours. And before it gets completely around, we can ship your less-than-mill quantity order of Timken® 52100 tubing. We can save you time because we carry 101 sizes of 52100 tubing in our mill warehouse.

And you'll save money, too, with Timken 52100 tubing—by substituting it for costlier alloy steels. You get a steel that's through-hardened in moderate sections, that can be hardened to file hardness or tempered back as you desire.

Hundreds of tons of Timken 52100 have been made into aircraft parts, ball bearing races, pump parts and plungers, collets, bushings, spindles, grinding machine parts and precision instruments.

You can rely on Timken 52100 steel. Our rigid quality control assures you uniformity from tube to tube, heat to heat, order to order. We pioneered 52100 tubing in America, and we're the only company that makes 52100 steel in all three products—tubing, bars and wire.

Give us 24 hours and we'll have your Timken 52100 tubing on its way to you. It's available in O.D.'s from 1" to 10½" and a wide variety of wall thicknesses. Write, phone or wire: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

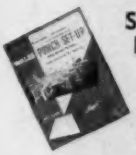
SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE INFORM-A-GRAM KEY NO. 16

"Best yet... for Heavy Duty HOLE PUNCHING up to ¼" steel"

"Our CJ Tooling is fast and clean for heavy duty work on sheets, and we're also getting big profit from punching holes in channels, angles etc. That's a tough proposition for the average shop . . . but not for us! With our WALES equipment we cut vees and corner notches at the same time. It really boosts our production."

WALES CJ Units punch unlimited straight line, staggered and scattered patterns . . . round or shaped holes. Die retention design features rapid die change WITHOUT REMOVING UNIT from set-up . . . provides controlled slug ejection. Time saving and money saving. Same units may be used over and over again in other patterns.



SEND FOR BULLETIN NO. 27J

Shows actual job work and complete data of CJ sizes.

WALES MOBILE FIELD UNITS

Will demonstrate CJ and other tooling right at your door. Ask for details.

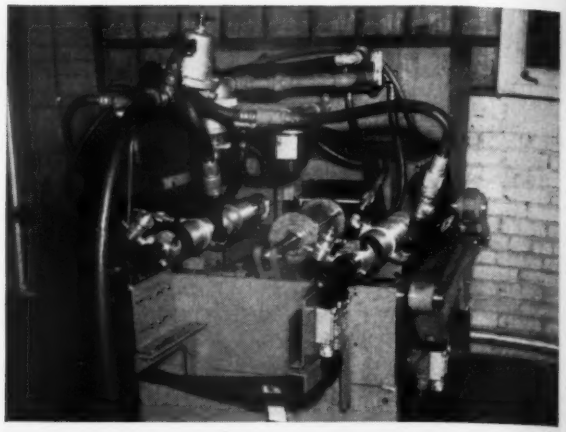
WALES Strippit COMPANY

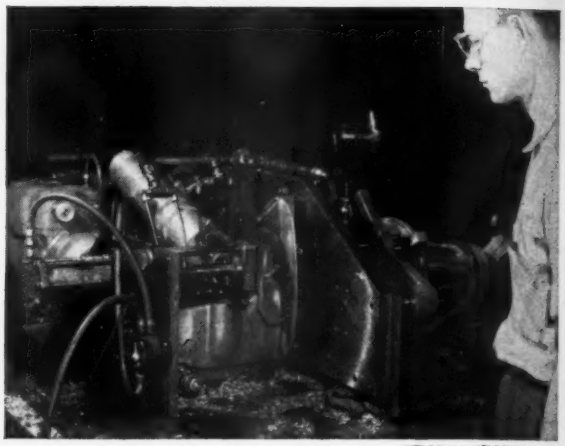
A UNIT OF HOUDAILLE INDUSTRIES, INC.

AKRON, NEW YORK

WALES-STRIPPIT OF CALIF., SOUTH GATE, CALIF.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

"...the Wales-Way is the PLUS-PROFIT way"

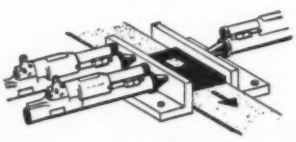




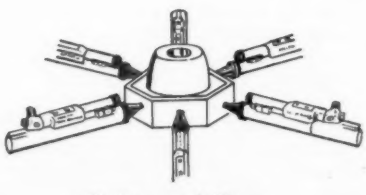
for accurate holes in a hurry
. . . USE KELLER TOOL "AIRFEEDRILLS"®

"AIRFEEDRILLS" are easily adapted to almost any drilling setup. You mount them as a drilling unit of from two to 20 spindles for automatic hole processing. Use one as a stationary drill mounted on an inexpensive fixture. As a portable drill, "AIRFEEDRILL" hangs by its nose to a jig for precision drilling.

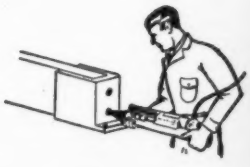
If you are drilling, reaming, countersinking, chamfering, counterboring or spot facing, ask your Gardner-Denver representative to show you how a Keller Tool "AIRFEEDRILL" setup can help you save time and cut costs. Or send for bulletins on Keller Tool "AIRFEEDRILL" units and drill bushing tips.



Automatic drilling unit



Stationary drilling



Portable unit

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

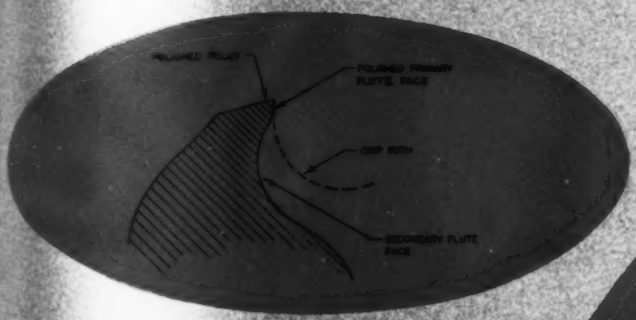
Gardner-Denver Company, Quincy, Illinois

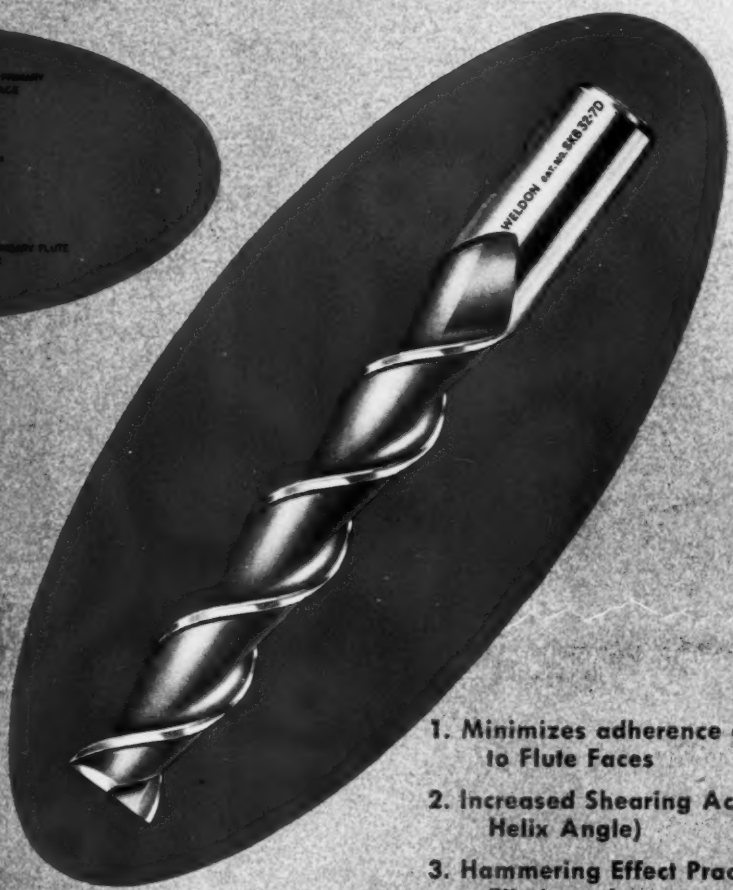
CIRCLE INFORM-A-GRAM KEY NO. 18

NEW! WELDON *Ski-Kut* END MILLS

FOR CUTTING ALUMINUM

PATENT APPLIED FOR





CUTTING ALUMINUM MADE EASIER, SMOOTHER AND FASTER

The primary flute face of the Ski-Kut End Mills, being narrow, definitely minimizes adherence of chips to the flute faces. Adherence or welding of aluminum chips contributes in a major degree to the difficulty in milling aluminum.

Greater feeds, longer tool life, better finish, easier operation of equipment are some of the advantages to be gained by the use of Weldon Ski-Kut End Mills for cutting aluminum.

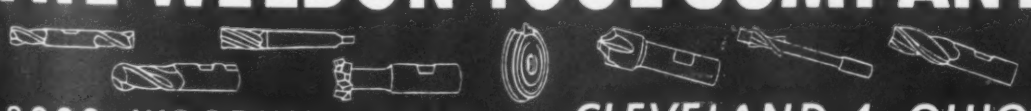
1. Minimizes adherence of Chips to Flute Faces
2. Increased Shearing Action(45° Helix Angle)
3. Hammering Effect Practically Eliminated
4. Greater Feeds
5. Longer Tool Life
6. Better Finish
7. Easier Operation
8. Less Horsepower Required

A RADICALLY NEW DEVELOPMENT IN END MILL DESIGN FOR CUTTING ALUMINUM THAT SPEEDS PRODUCTION AND REDUCES COST.

Weldon SKI-KUT End Mills are available from stock in size from 1/4" to 2" in various lengths. For full information write for folder SKM-1

Weldon Distributors throughout U. S. A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY



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A **POWER OPERATED BARREL TYPE SLIDE ADJUSTMENT** facilitates and speeds die-setting. Push button operated, it's not only fast and smooth but permits micro-positioning within a thousandth of an inch.

B **HYDRAULIC INCLINING DEVICE** operates smoothly. The press can be inclined or brought upright in approximately 2 minutes. Operating lever and push buttons conveniently located on left panel leg.

C **BRAIN CENTER OF THE AUTOMATION SYSTEM,** the Rotary Limit Switch can be adjusted precisely while the press is in motion for synchronizing automation devices with press cycle.

D **LOW INERTIA, ELECTRO-PNEUMATIC FRICTION CLUTCH** operates directly on the crankshaft. Most of its weight continues to rotate with the main gear. Only the crankshaft and driving plate are started and stopped at each cycle. Heat and wear are reduced to an absolute minimum. Torque capacity may be changed by adjusting air pressure.

a truly revolutionary line of OBI's

automated to hit new production highs

Never before has there been an OBI like this. In feature after feature, you'll see pulse-quickening newness that will inject speed and rhythm into your production. Outfitted with today's most advanced controls and devices, this all-new Niagara Series EA offers you automation at its very best.

Boasting a revolutionary front-to-back crankshaft design, it's streamlined in an ultra-modern, functionally sound, eye-pleasing way. In fact, it's the only totally-enclosed OBI ever made. There are no exposed, overhanging gears, flywheel or other mechanisms. With the entire driving assembly fully enclosed within the limits of the compact frame, this trim-line performer actually takes up less floor space than any press in its range and category. It's only natural that such a triumphant line of OBI's as this should parade from Niagara . . . for Niagara has been leading the way, *all of the way,* in building all types of OBI's — single crank and double crank, standard and fully automatic. Hailed as "the latest and greatest of them all," the Series EA is built in 4 sizes, with shaft diameters from 4½ to 7½ inches and capacities from 75 to 200 tons.

FULL DETAILS ARE YOURS FOR THE ASKING:
Write for illustrated Bulletin 56 today!

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

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Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

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E **AIR CONTROL PANEL AND HYDRAULIC INCLINING SYSTEM** are neatly housed within the left leg. Air line filter, pressure regulator, gages, blow-off valves and lubricators, as well as the hydraulic pump for the inclining system, are all concealed behind a dust-tight door.

F **AUTOMATIC CIRCULATING OIL SYSTEM** (left panel leg) sends metered flow of clean, filtered oil to all bearings and gears in the crown, air counterbalance and slide gibs. Correct operating oil pressure is maintained or the press stops automatically.

G **CONTROLLED AIR SUPPLY AND PNEUMATIC TIMING RELAYS** (left panel leg): Air line receptacles, synchronized with press cycle, are provided for die doper, die kicker and die lifter . . . with auxiliary receptacles for die maintenance tools. Adjustable timing relays control interval of automation functions initiated by rotary limit switch.

H **OPERATOR'S PANEL** (right panel leg) features deluxe operating controls conveniently arranged for fingertip direction of every press motion. Chained to safety block, safety plug de-energizes entire press control when pulled from its receptacle.

I **COMBINATION MOTOR AND PRESS CONTROL PANEL** fully enclosed within the right leg behind a flush-mounted, dust-and-oil-tight door, houses: disconnect switches, circuit protection, transformers, fuses for main motor and auxiliary power supply; control relays; starters for main motor, lubrication and hydraulic pumps.

PNEUMATIC CUSHION is automatically lubricated by self-contained pumping system; internally guided and rigidly supported by press frame.

NIAGARA

front-to-back crankshaft AUTOMATED INCLINABLES

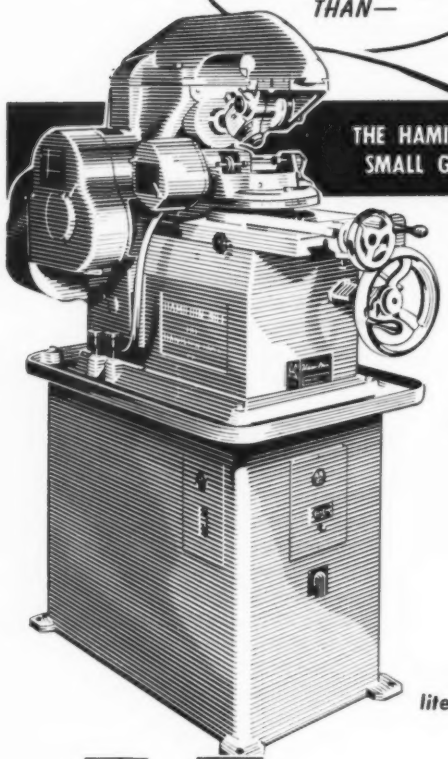
America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

CIRCLE INFORM-A-GRAM KEY NO. 21

ALL THE **PRODUCTION** YOU'LL EVER WANT — ALL THE **PRECISION** YOU'LL EVER NEED

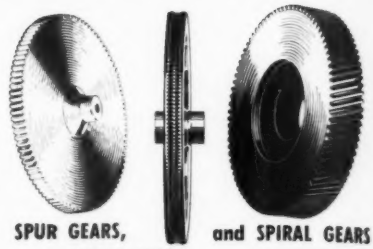
BUT MY WORK INCLUDES THE MANUFACTURE OF—

I KNOW! AND YOU CANNOT POSSIBLY BUY A BETTER MACHINE FOR THE JOB THAN—



THE HAMILTON No. 1-B PRECISION SMALL GEAR HOBBING MACHINE

INVESTIGATE IT! YOU'LL SEE!



SPUR GEARS, WORM GEARS, (up to 6" O.D.) and SPIRAL GEARS

WORMS

SPECIAL TOOTH FORMS

GEAR SECTORS

PINIONS

and FACE GEARS

and BEVEL GEARS (up to 3" O.D.)

2564

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Hamilton

PRECISION SMALL-GEAR HOBBING MACHINE

THESE ARE REPRESENTATIVE USERS OF HAMILTON GEAR HOBBING EQUIPMENT

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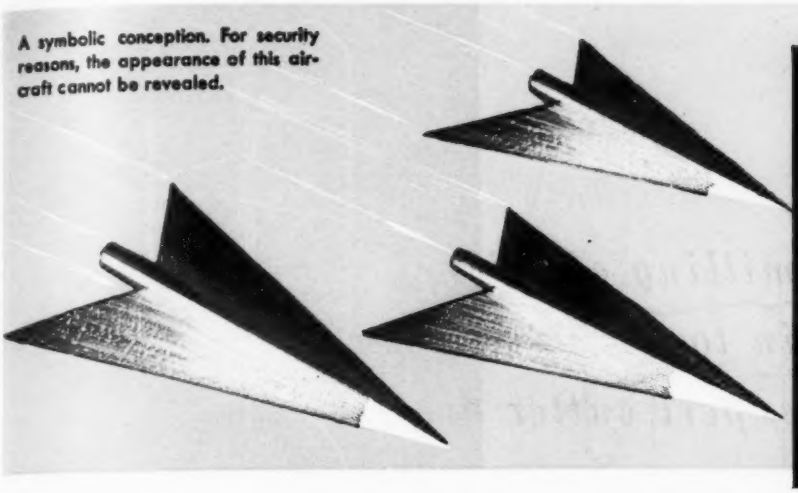
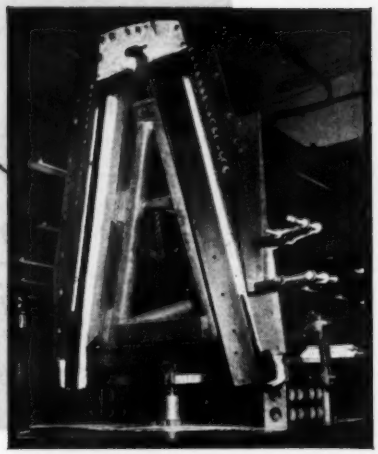
THE HAMILTON TOOL COMPANY • 832 SOUTH NINTH STREET • HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 22



A symbolic conception. For security reasons, the appearance of this aircraft cannot be revealed.



A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.

In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

EPON® RESIN

dies, tools, jigs, molds and fixtures

Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

The Epon resins have an ideal combination of properties for tooling applications. To list just a few:

- Exceptional dimensional stability, high impact strength, excellent resistance to abrasion, minimum residual stress in cured parts.
- Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproduction; minimum warping and stresses.
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for *production* as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.

Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.

Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

SHELL CHEMICAL CORPORATION

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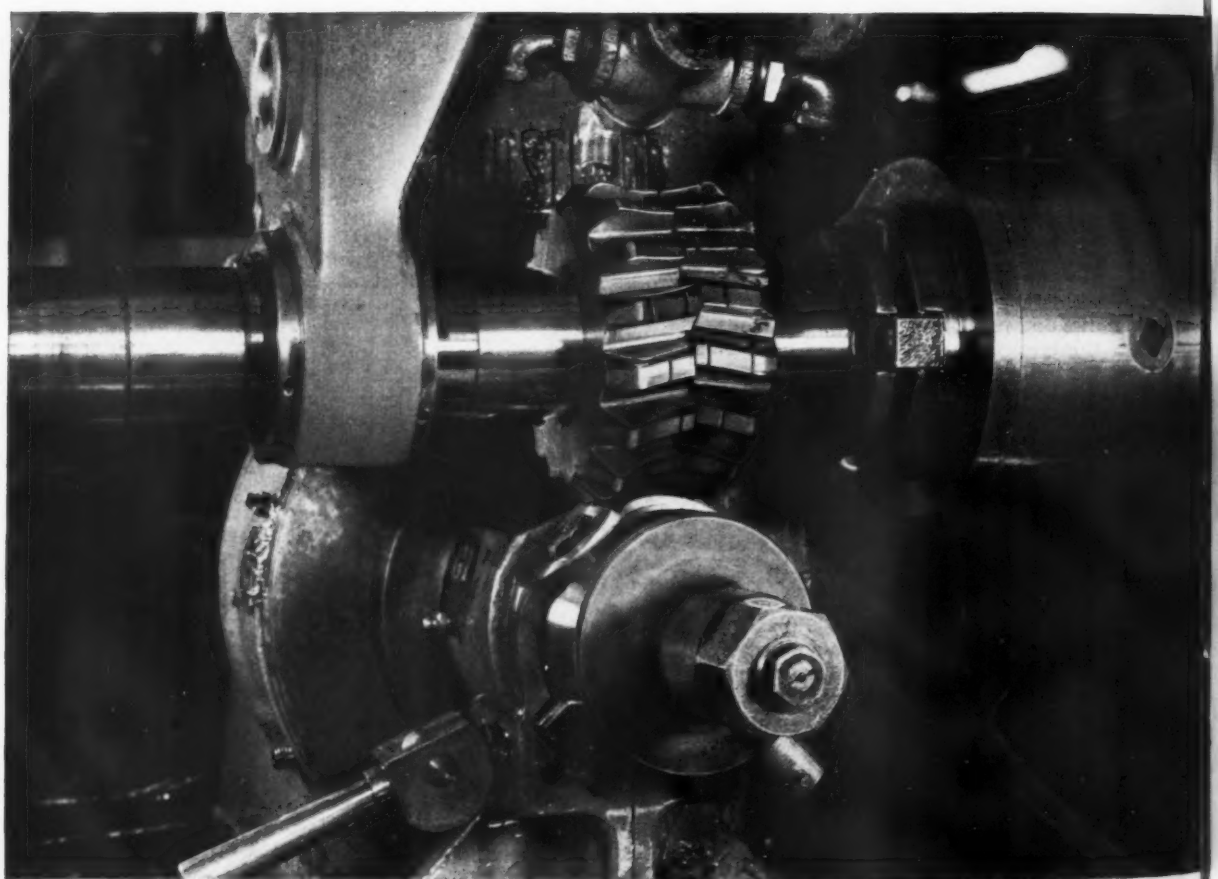
SHELL

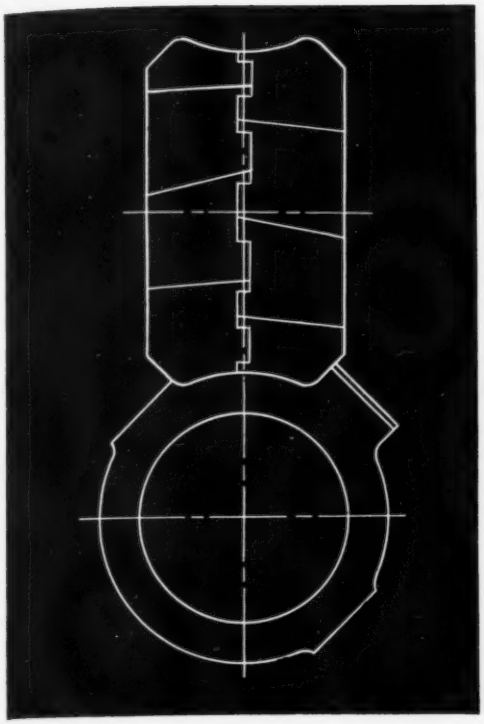
CIRCLE INFORM-A-GRAM KEY NO. 23

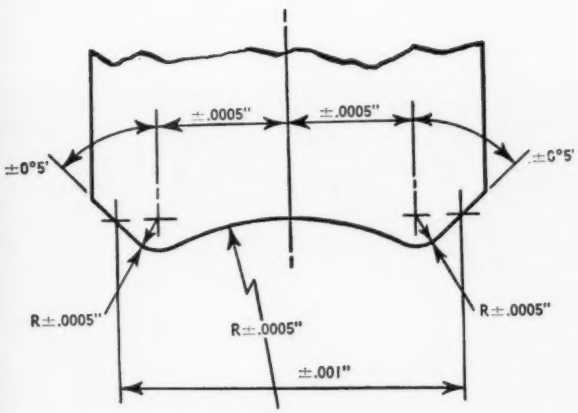
milling efficiency ✳
in tough steel calls for
expert cutter design

✳ **interlocking cutter with helical flutes in both directions provides positive cutting action in high alloy steel**

✳ **ground form-relieved cutter provides required accuracy for this aircraft part**







Cutter Tolerances

Accurate milling of this high alloy steel part for Sundstrand Aviation requires a combination of expert cutter design and precision cutter manufacture. To accomplish this job, Barber-Colman engineers designed a ground, form-relieved, interlocking cutter which is 6" in diameter.

Since the material is tough alloy steel for an aircraft part, the cutter is made in two interlocking sections so that each half of the cutter can have helical flutes in opposite directions. This design provides positive axial rake on the angular portion of each half of the cutter, resulting in a shearing action as each side enters the cut. In addition, the alternate tooth design provides maximum overlap for smooth cutting action and fine finish. A free flow of chips is obtained by the combination of the opposite-hand helical flutes and the alternate teeth.

The form on this cutter is ground to hold the close tolerances required on the part. Each of the radii is held to a tolerance of ±.0005". The width of each half from the center of the radius to the center of the cutter is held to ±.0005", with an overall tolerance of ±.001" when the cutter sections are assembled. The form must fit the layout within .0005", and this tolerance is inspected to include the effect of axial and radial runout. Accurate tolerances such as these can be provided for your parts by Barber-Colman ground form-relieved cutters.

A fine finish is obtained using a feed of .980 inches per minute and a speed of 80 SFM. The tolerance for finish is 125 RMS. Approximately 200 inches of this tough steel are milled per sharpening.

Results like these are evidence that when you are milling tough materials requiring accuracy and finish, expert cutter design and manufacture are essential for cutting efficiency and good tool life. Consult Barber-Colman cutter engineers on your milling cutter requirements. Their long experience and manufacturing knowledge can save you production time and costs.

BARBER-COLMAN COMPANY

81010 ROCK STREET • ROCKFORD, ILLINOIS

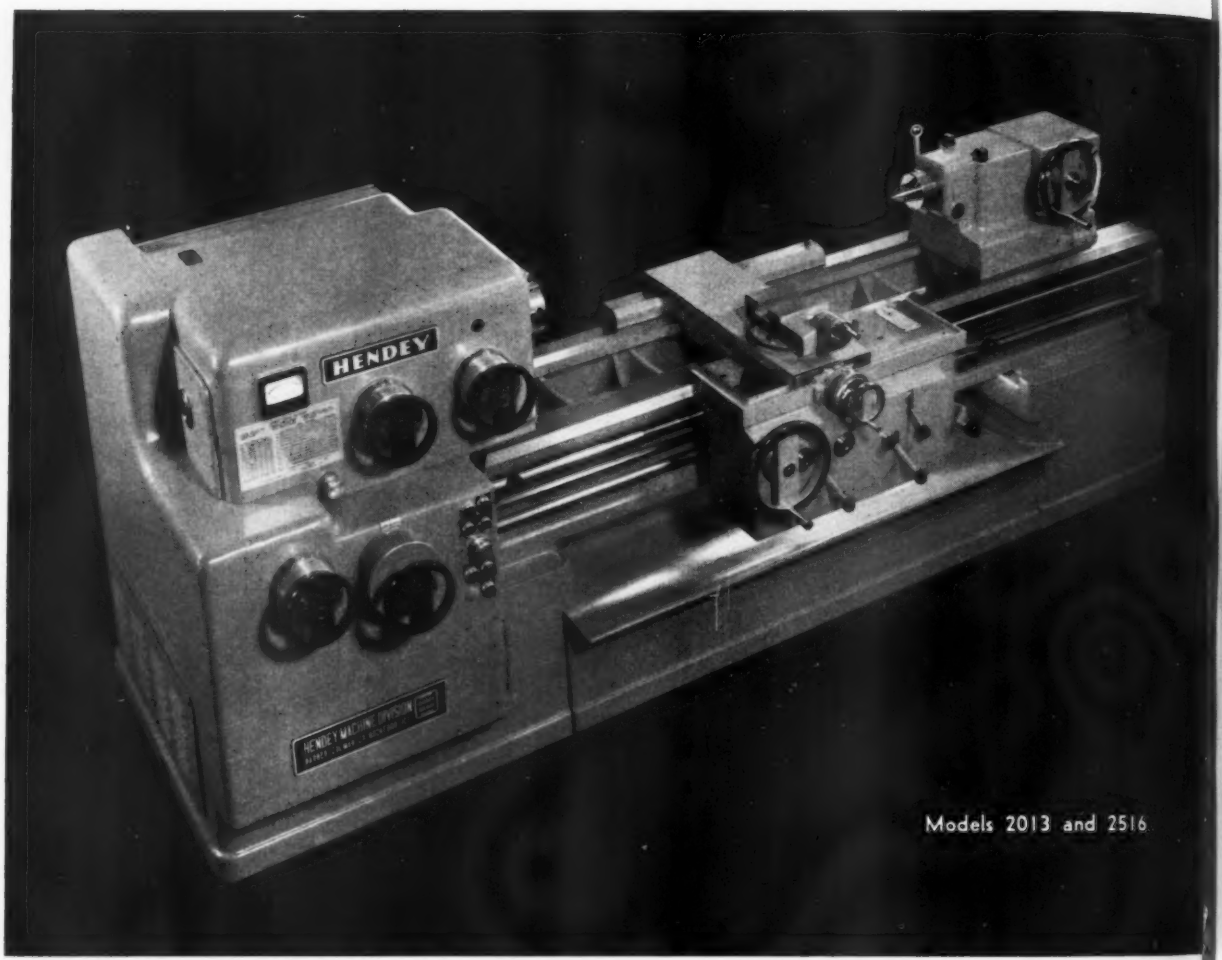
Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CIRCLE INFORM-A-GRAM KEY NO. 25

NOW! FROM HENDEY...

all new 32-speed



Models 2013 and 2516

More rigidity, more threading features, more lathe per dollar!

geared-head lathe

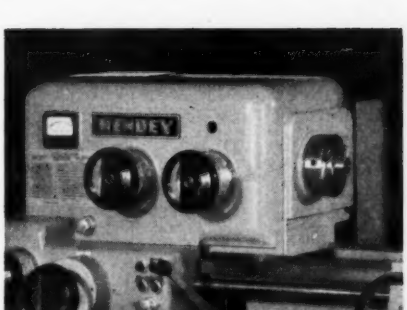
Here are the all-new Hendey No. 2013 and No. 2516 lathes, with a 32-speed geared head (up to 2000 rpm), a complete line-up of threading features, and heavy-duty design combined with toolroom precision. The 32-speed headstock transmission contains crowned, flame-hardened spur gears which are automatically lubricated. You select speeds simply by shifting gears. Greatly simplified mechanical design gives you lower maintenance costs — more machine, dollar for dollar, than any other lathe in its class.

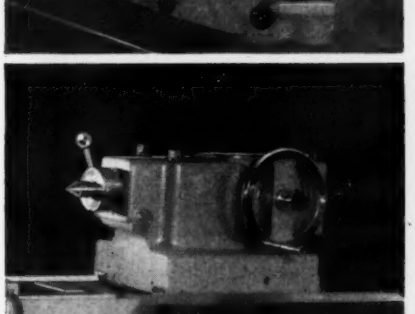
Three sets of super-precision tapered roller bearings support the spindle at both ends and in the middle, increasing accuracy and improving finish. An automatic spindle adjuster eliminates any manual adjustment of the spindle bearings regardless of the spindle speed.

The extra-heavy bed casting is made of dense, wear-resistant semi-steel, which is induction-hardened and ground on all way surfaces. Lathes can be furnished with a 15, 20, or 25 hp spindle drive motor and come equipped with a load meter and automatic overload release for the carriage feed.

Hendey has all the threading features, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 feed and thread changes, with 2 to 120 quick-change threads per inch and feed range from .0015 in. to .091 in. per revolution, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to the half nuts.

Compare these tailstock features with other lathes on the market: Weighing almost 400 lb, the tailstock can be positioned quickly and easily with one hand. And the ways under it are hardened and ground. Large 4½ in. diameter spindle has a full 10 in. extension, with slow and rapid traverse speeds.





Hendey machine division
BARBER-COLMAN COMPANY
107 Loomis St., Rockford, Illinois

BARBER COLMAN ®

CIRCLE INFORM-A-GRAM KEY NO. 27

Steel plates up to 10' x 1" are quickly cut on this Steelweld. A complete line of machines is available for every thickness from light gauge to 1½" and every length from 6'-0" to 24'-0".

Pivoted-Blade Shears Outstanding for Heavy Plates

WHILE Steelweld Shears are used in hundreds of plants for cutting every gauge of metal, it is on heavy plate where the easy accurate cutting action of the machine is really eye catching. With nothing more than a quick "oomph" the knife goes through the metal quickly and cleanly, seemingly without effort. The resulting cut edges are straight and sharp.

Steelweld Shears are now cutting steel up to 1½ inches thick. A wonderful feature is the ease and speed with which the heavy plate machines can be adjusted to cut the lightest gauge metal. In a matter of seconds the clearance between the knives can be reduced to that known to provide the best result for the thickness of the plate being cut. This is done simply by turning a crank until a gauge indicator is on the correct thickness figure. This feature is known as MICRO-SET knife adjustment and is the talk of the industry.

Production is fast on Steelwelds because they are heavily built to enable high operating speeds. Also, they are equipped with electric foot control. This reduces operator fatigue and often eliminates many steps he must take to the machine.

If you want the most modern machine, with outstanding features that make for the finest in all around performance — tried and proven features, some of which are not obtainable in any other shear — we invite you to get the facts on Steelwelds.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

8747 EAST 281st STREET • WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

CIRCLE INFORM-A-GRAM KEY NO. 28

Acme-FETTE

... cut cost... ROLL better threads... faster

JOB FACTS: Rolling a 5/8"-18 thread in C-1117 steel on a Type N-2 self-opening Acme-Fette Thread Rolling Head.

even on this short run

threading costs reduced from 50 cents to 1 cent per piece

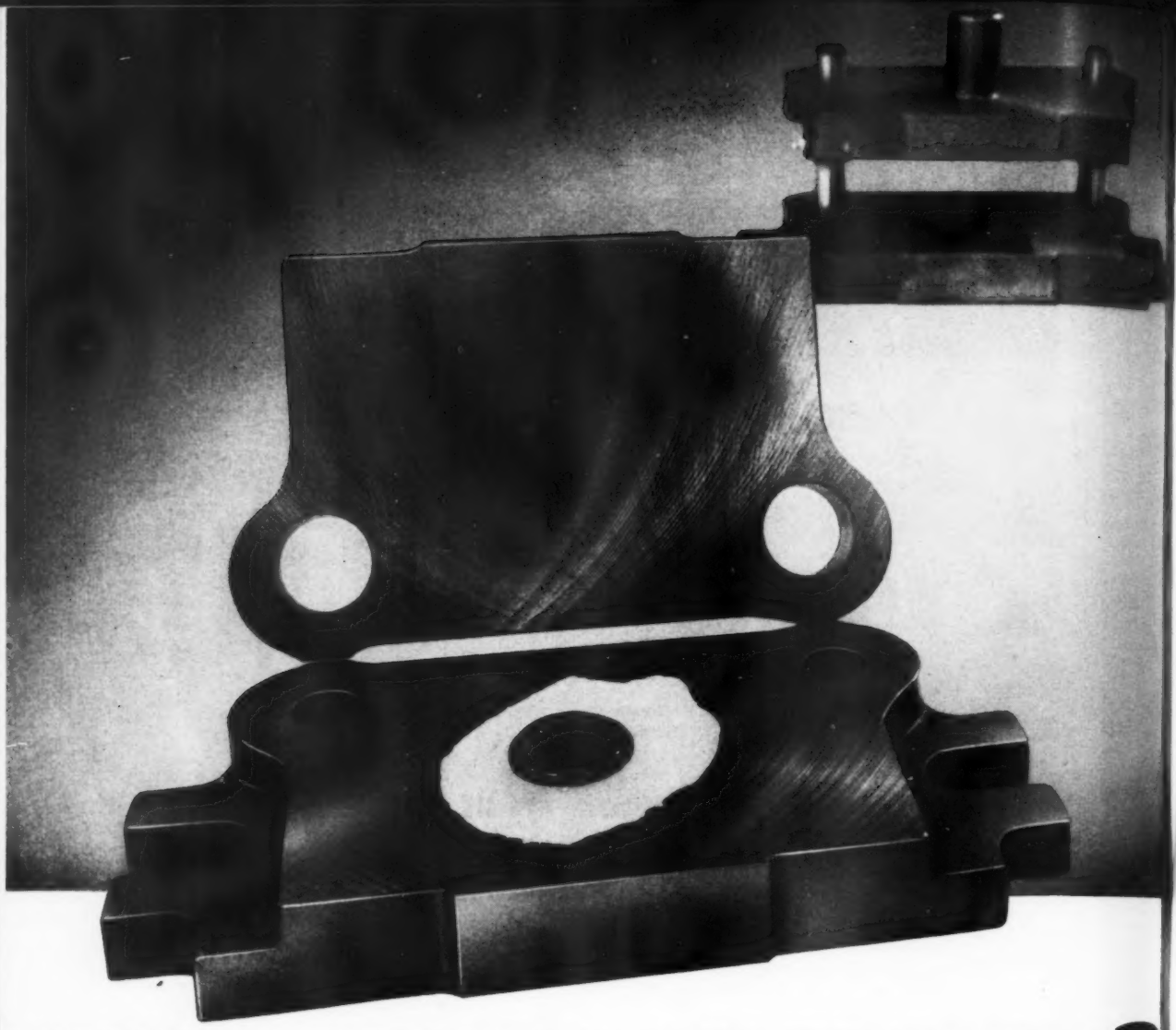
As reported by Mr. Arnold Thompson, President, Thompson Tool and Manufacturing Company, Franklin, Ill., manufacturers of the "Dress-O-Grind" grinding fixture.

When thread chasing failed to provide the required finish for this Class 3 thread fit air rotor—and thread grinding proved too costly—this manufacturer turned to *thread rolling*, using the versatile* new N-2 Acme-Fette Self-opening Thread Rolling Head, on a hand screw machine.

"As a result," states Mr. Thompson, "on a test run of only 1000 pieces, our threading cost dropped from 50 cents to one cent per piece . . . and we maintained the finish we had to have throughout the run, without a single adjustment."

While the Acme-Fette Thread Rolling Head has built its reputation on long runs (often running into the millions) don't overlook the many advantages it offers—*even on short runs!*

National Acme



WHAT'S COOKING ON DIE SETS?

The egg you've laid, brother, if the job isn't right.

Whether you're the tool engineer or the diemaker, once the die's in the line it has to produce or you've had it. And today it has to produce hundreds of thousands, even millions, of parts to pay for itself.

Obviously the die set is no place to cut corners. It's not only the heart of the die but frequently it's the least expensive part of the die anyway. A few dollars saved here won't go very far spread out over the life of the die, and it can prove costly.

Making quality die sets is our business. Quality means precision and stamina:

Precision for fast, accurate diemaking and lasting production accuracy.

Stamina to assure long, trouble-free operation in the line.

For your convenience, Detroit Die Set stocks over 2000 standard die sets. Our new catalog covers them all, plus details on specials, too. Ask for your copy on your company letterhead today.

OFFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

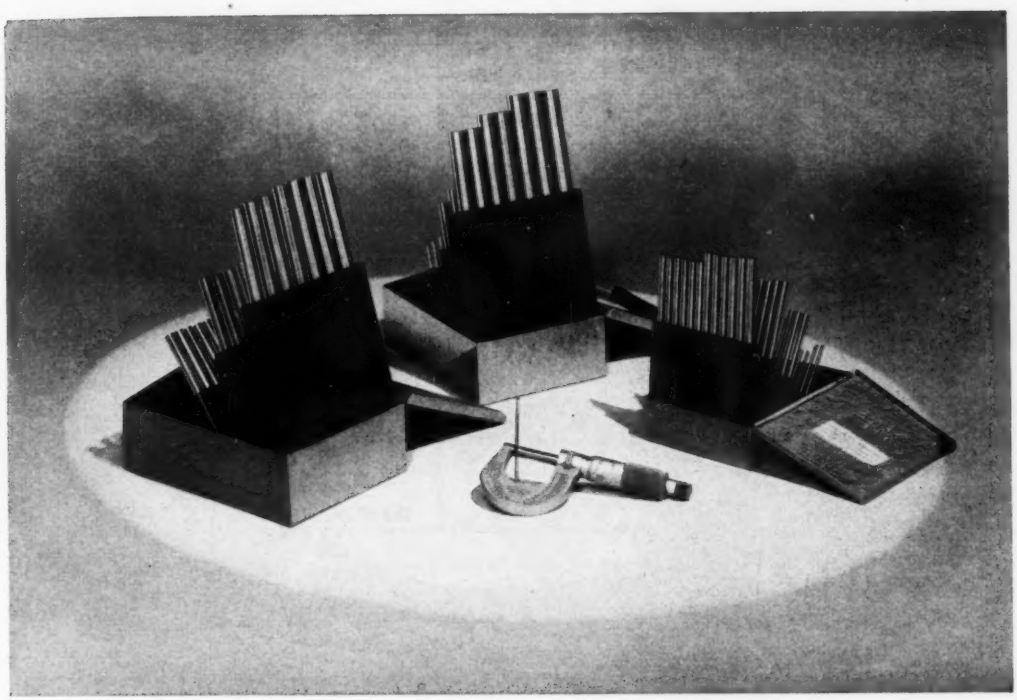
CIRCLE INFORM-A-GRAM KEY NO. 30

DRexel 6-4222 ESTABLISHED 1927

WILLIAM T. HUTCHINSON CO.

53 BROWN AVENUE SPRINGFIELD, NEW JERSEY

HUTCHINSON HSS BLANKS



115 Pieces – COMPLETE – .040" to .500" – $88.00

your choice of two tolerances
+ .0002" — .0000
or
+ .0000 — .0002"

JOBBER SET	LETTER SET	WIRE SET
$32.27	$29.03	$27.40
in Huot Index	in Huot Index	in Huot Index

HIGH SPEED STEEL — 64 "C" scale hard — gage tolerance — mirror finish. parallel ground

ANY DECIMAL DIAMETER OF STANDARD LENGTH .020" TO 1.000" SHIPPED ON 24 HOUR NOTICE

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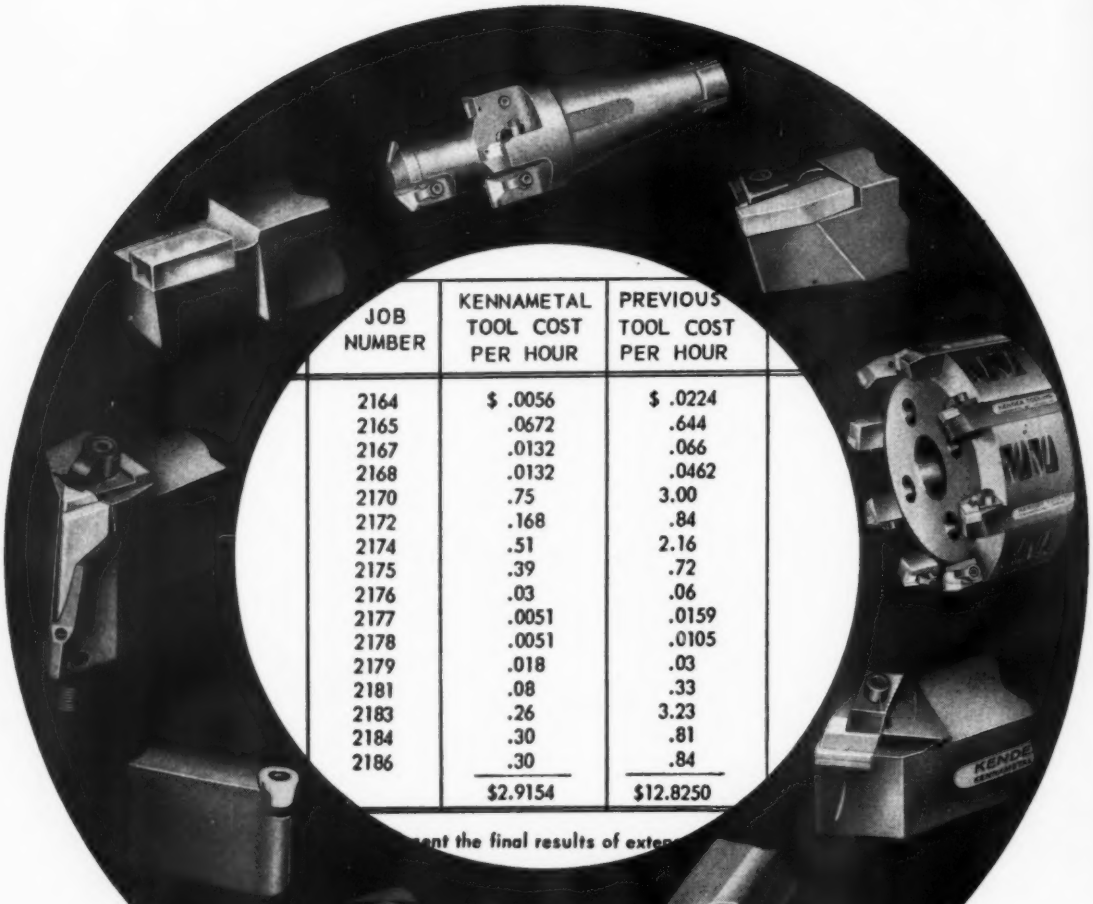


JOB NUMBER	KENNAMETAL TOOL COST PER HOUR	PREVIOUS TOOL COST PER HOUR
2164	$ .0056	$ .0224
2165	.0672	.644
2167	.0132	.066
2168	.0132	.0462
2170	.75	3.00
2172	.168	.84
2174	.51	2.16
2175	.39	.72
2176	.03	.06
2177	.0051	.0159
2178	.0051	.0105
2179	.018	.03
2181	.08	.33
2183	.26	3.23
2184	.30	.81
2186	.30	.84
	$2.9154	$12.8250

...ent the final results of exte...

It took KENNAMETAL* Tooling—*plus* KENNAMETAL Tool Engineering Service—to get these results!

There's nothing much that words can add to the story told by the comparative cost figures above. On sixteen separate applications, Kennametal tool cost per hour (center column) totaled $2.9154—less than one-fourth as much as the $12.8250 cost for tools previously used (right hand column).

On this basis, the Kennametal tool cost of $17,490 per year cut previous expense by $59,460!

It takes a combination of quality tools and *scientific* service to produce results like this. Kennametal has built its business upon this combination.

A Kennametal Tool Engineer will work with your personnel, in analyzing various machining jobs to get the best results on each operation. The extensive selection of standard Kennametal tooling usually provides the exact tool needed to handle the work . . . if not, he can make the proper recommendations.

When desirable, in-plant training courses can be conducted by Kennametal representatives to help your personnel in the selection, application and care of tools to get the most from your tool dollars.

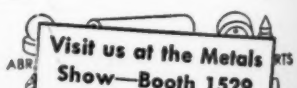
We will be glad to give you full information on how Kennametal tools and Kennametal service can help you. Just write, outlining your particular problem, to KENNAMETAL INC., Latrobe, Pennsylvania.

*TRADEMARK C-3088

MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND KENNAMETAL ...Partners in Progress



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PERCUSSION AND IMPACT PARTS

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Mill·Bore·Shape Slot·Grind·Drill

Here's a new machine that will do all these jobs...and more

...anywhere!

The Dumore Versa-Mil is a compact, rigid design, comparatively light weight, *portable* precision machining unit. It performs with extreme efficiency at any angle in any required position or direction, as an independent unit with its own power and feeds, or added to machine tools—lathes, planers, shapers, millers, grinders.

It maintains close tolerances while removing metal at profitable rates on work situated on standard machines, fixed machinery in place, pieces in fixtured set-ups and on parts too big for standard machines. It gives *you* the advantages of machining where it is most economical!

It would pay you to get all the facts about this versatile, new machine tool. Find out all the things it can do and the economies it can give you . . . send the coupon *NOW!*

NEW
DUMORE
VERSA-MIL
PORTABLE PRECISION MACHINING
• You gain the advantage of machining where it is most economical
• You increase your machining capacity, accuracy and efficiency
• You save handling, moving, set-up and downtime
• You save space and the high cost of single-purpose machines
Made by the makers of the famous universally used DUMORE TOOL POST GRINDER

FOR MAINTENANCE, SHOP, TOOL ROOM AND MASS PRODUCTION USES

GET THE FACTS . . . NOW!

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Company_____

Address_____

City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 33

1½ times actual size

220 MILLION PIECES

FROM THIS 12-STATION TOOL STEEL DIE

Photo courtesy of Warner Die & Stamping Co., Cary, Illinois, makers of this die.

Tolerances on the intricate shaft-mounted spring shown here are plus .003", minus .000" . . . no burrs allowed . . . and stamping speed is better than 240 a minute. This calls for die-making precision—and a precision die set.

Reliable, consistent precision of the Danly Die Set provides the closure accuracy necessary to the performance of this fine die. After this unusually long run of a precision stamping in a tool steel die, the die set is in good condition.

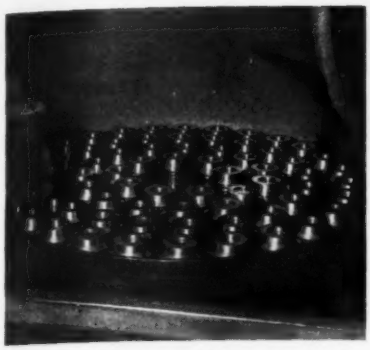
Danly production methods consistently maintain the highest standards of die set precision through individual control of every critical dimension. Thousands of fine tool and die shops agree that the finest die set obtainable is usually the lowest cost insurance on any die-making investment. Find out how Danly precision can save money for you.

DANLY MACHINE SPECIALTIES, INC.
2100 S. Laramie Ave. Chicago 50, Illinois

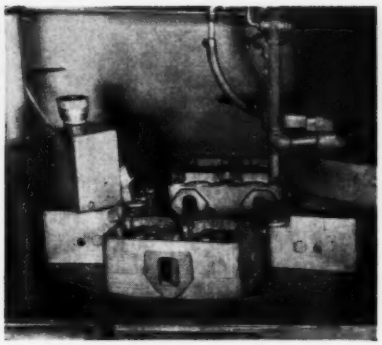
Write for new folder on **"The Importance of Die Set Precision"**

Lists and discusses all critical dimensions . . . shows how and why consistent Die Set precision is vital in every die-making operation. Send for a free copy.

Whatever your grinding job may be...



200 adjusting screw washers are ground on one side in one hour. Stock removal .025"; limits ± .001".

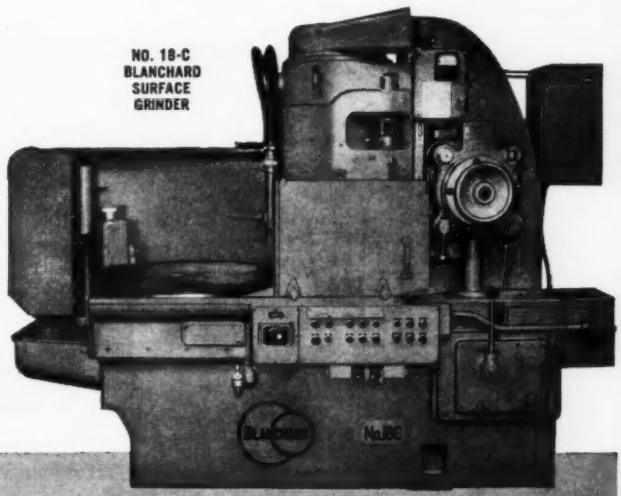


Tops of cylinder heads ground 21 per hour; stock removal 3/16" to 1/4". Bottoms 55 per hour; stock .012"; limits ± .001".

56 cast iron plates are ground on one side in one hour. Stock removal .140"; limits .001".

for best results...

The Blanchard No. 18-C Surface Grinder has the speed and precision that guarantees economical grinding on an endless variety of jobs. After the initial setup, the automatic cycle handles every operation from start to finish. The operator is freed to prepare the next load or to operate a second No. 18-C Grinder.



NO. 18-C BLANCHARD SURFACE GRINDER

Put it on the Blanchard

The 18-C Automatic Cycle...

Moves chuck to grinding position and starts it rotating

Starts wheel rotation and coolant pump

Provides rapid wheel approach to work

Engages power down-feed at preset rate

Changes to fine feed just before finished size is reached

Stops feed when work is to size — "sparks" out. Raises wheelhead

Stops wheel, coolant pump, and chuck

Moves chuck to loading position — demagnetizes chuck

Can be changed quickly to manual operation

Automatically Controls Size!

Send today for your free copy of 18-C folder.

BLANCHARD

THE BLANCHARD MACHINE COMPANY

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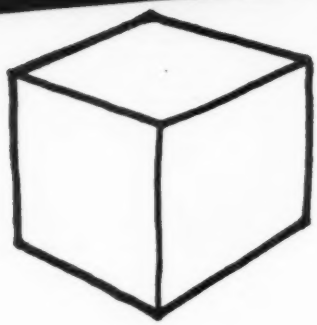
CIRCLE INFORM-A-GRAM KEY NO. 35

DROODLES

by ROGER PRICE



Bench Model BC-7C

Floor Model FC-30

Floor Model FC-14

"ALL-PURPOSE DO-IT-YOURSELF KIT"

This square reminds me somehow of my pal, Sir Geoffrey Crum, Bart., the kippered herring king, whom I met while in England recently. At his insistence, I spent a week-end at Vertigo Manor, his country estate. Had a ripping time, really. Food and service were absolutely top-hole, and the Crums were capital hosts. Seemed a bit flustered when they learned I'd won a few bob from the help, shooting craps in the butler's pantry. Later, however, I overheard an admiring remark concerning my agility on the tennis court. Something about my being "a remarkable bounder", if I recall correctly. All in all, I made a tremendous impression, and was cordially invited to visit again. On the millenium, whenever that is. I'll have to look it up.

One thing I don't have to look up is the Jones & Lamson Optical Comparator. Throughout industry this precision-built measuring and inspection instrument is helping to increase production and cut costs by rapidly and accurately checking all sorts of parts and objects. It detects flaws immediately, so scrap is kept to a minimum. The J & L Comparator is equally suitable for long production runs or small-lot work. Even intricate parts are easily inspected to .0001", and the J & L's amazing flexibility makes it simple to perform inspections previously considered to be impossible. J & L Optical Comparators are available in a range of eleven different models, both bench and floor types. For complete information, send this coupon *today*.

JONES & LAMSON COMPARATORS *On the Job . . .*

at Scott & Williams, Inc., Laconia, N. H.

For inspecting the development on stitch cams of circular knitting machines, J & L designed a staging fixture that unwraps the helical surface of the cam, in front of the comparator lens.

A rack and pinion arrangement on the fixture revolves the cam through the focal plane of the comparator. Thus the entire cam surface, greatly magnified on the master outline chart, can be seen at a glance.

If *you* have a difficult inspection problem, call on J & L's application engineers for expert advice and help.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U.S.A.

Please send me Comparator Catalog 5700, which describes the complete line of J & L Optical Comparators.

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company _____ city _____ zone _____ state _____

CIRCLE INFORM-A-GRAM KEY NO. 36

CHOICE OF BUILT-IN VALVES GIVES CONTROL FLEXIBILITY

SINGLE AIR CONNECTION SIMPLIFIES INSTALLATION

RUGGED CONSTRUCTION ASSURES LONG LIFE

125 BELLOWS SALES AND SERVICE FIELD ENGINEERS

■ There are one or more Bellows Field Engineers in every industrial area of the United States and Canada. They will be happy to work with you in applying "Controlled-Air-Power" to your machine designs. They are listed in their local phone directories under "The Bellows Co."

758-B

Four reasons why THE BELLOWS AIR MOTOR stands first with tool engineers

In designing for air cylinder operation the engineer wants first of all sure, positive control, easily interlocked to related machine movements. **He has it in The Bellows Air Motor.**

He wants simple installation, uncomplicated by cumbersome piping. **He has it in The Bellows Air Motor.**

He wants rugged construction — an air cylinder that will stand up day in and day out with minimum requirements for service and repairs. **He has it in The Bellows Air Motor.**

But he also wants the knowledge, if service should ever be needed, that it is quickly available wherever his machine may go. **He has it in The Bellows Air Motor.**

The Bellows Co.

AKRON 9, OHIO

This free booklet offers interesting data for the design engineer. Write for it today. Address Dept. TP-1057. Ask for Bulletin BM-25. The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd.

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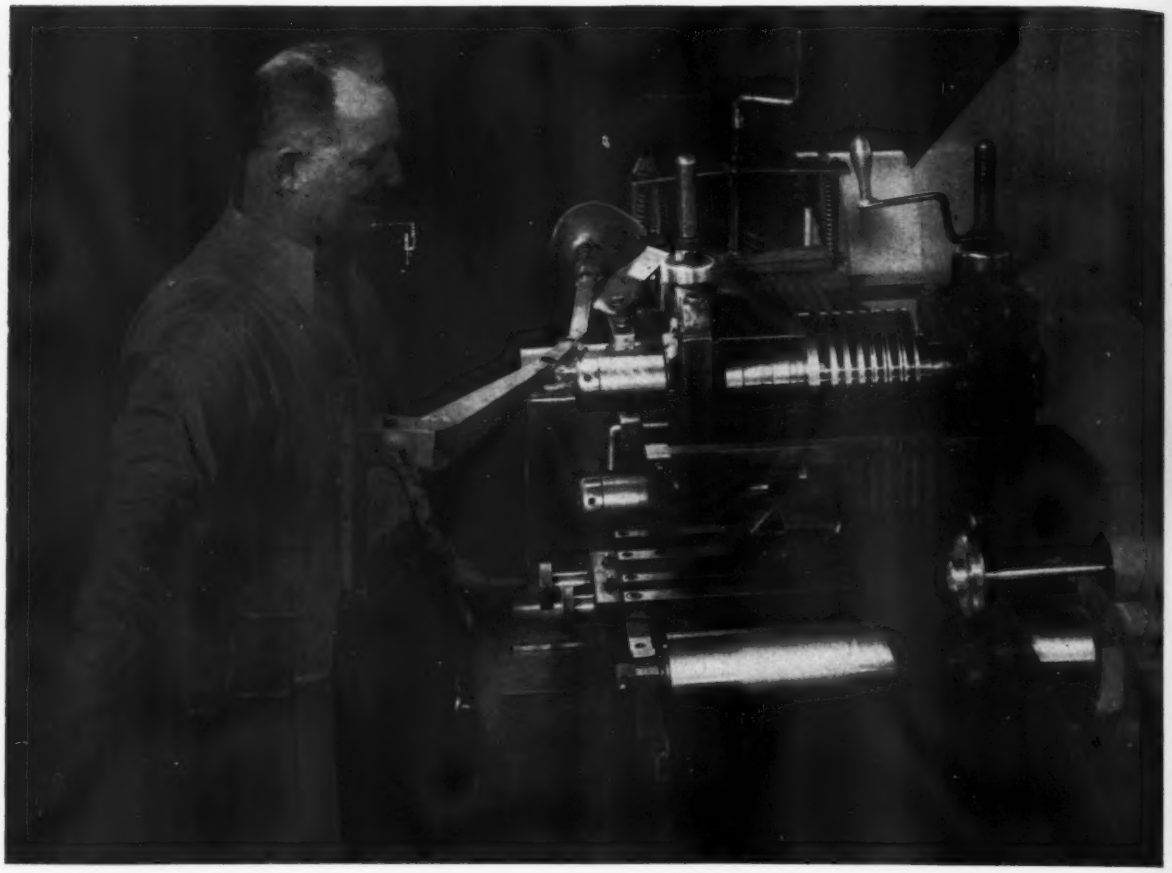

Yoder Slitters Supply Varied Strip Widths for Tinnerman *Speed Nuts*®

Tinnerman Products, Inc., Cleveland, Ohio, produces more than 10,000 different shapes and sizes of "SPEED NUT" brand fasteners for industry . . . many of them to special specifications.

To do this, Tinnerman uses slit steel strands ranging in width from ⅛" to 7½". To carry an inventory of the many strip widths required to meet normal and unusual demands would be almost impossible.

Tinnerman overcomes these inventory and supply problems by doing their own slitting on two Yoder slitters. This enables them to supply the plant with any strip size required from a relatively small inventory of 6" and 9" width purchased coils. In slitting narrow strands, such as these from small coils, a Yoder slitter may be profitable on a production as low as 25 tons per month.

Here is a fine example of how a small investment in Yoder slitting equipment greatly simplifies and speeds production while effecting important operating economies.

The saving made in time alone, reflects in better customer service through faster completion and delivery of finished products.

If your steel strip or sheet slitting requirements are as low as 100 tons per month or even less, a medium size Yoder slitter can be a very profitable investment for you. The Yoder line includes units of every size and capacity . . . of the most advanced engineering design. Send for the Yoder Slitter Book—a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. Write to:

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ROTARY SLITTING LINES

PIPE AND TUBE MILLS (ferrous or non-ferrous)

COLD ROLL FORMING MACHINES

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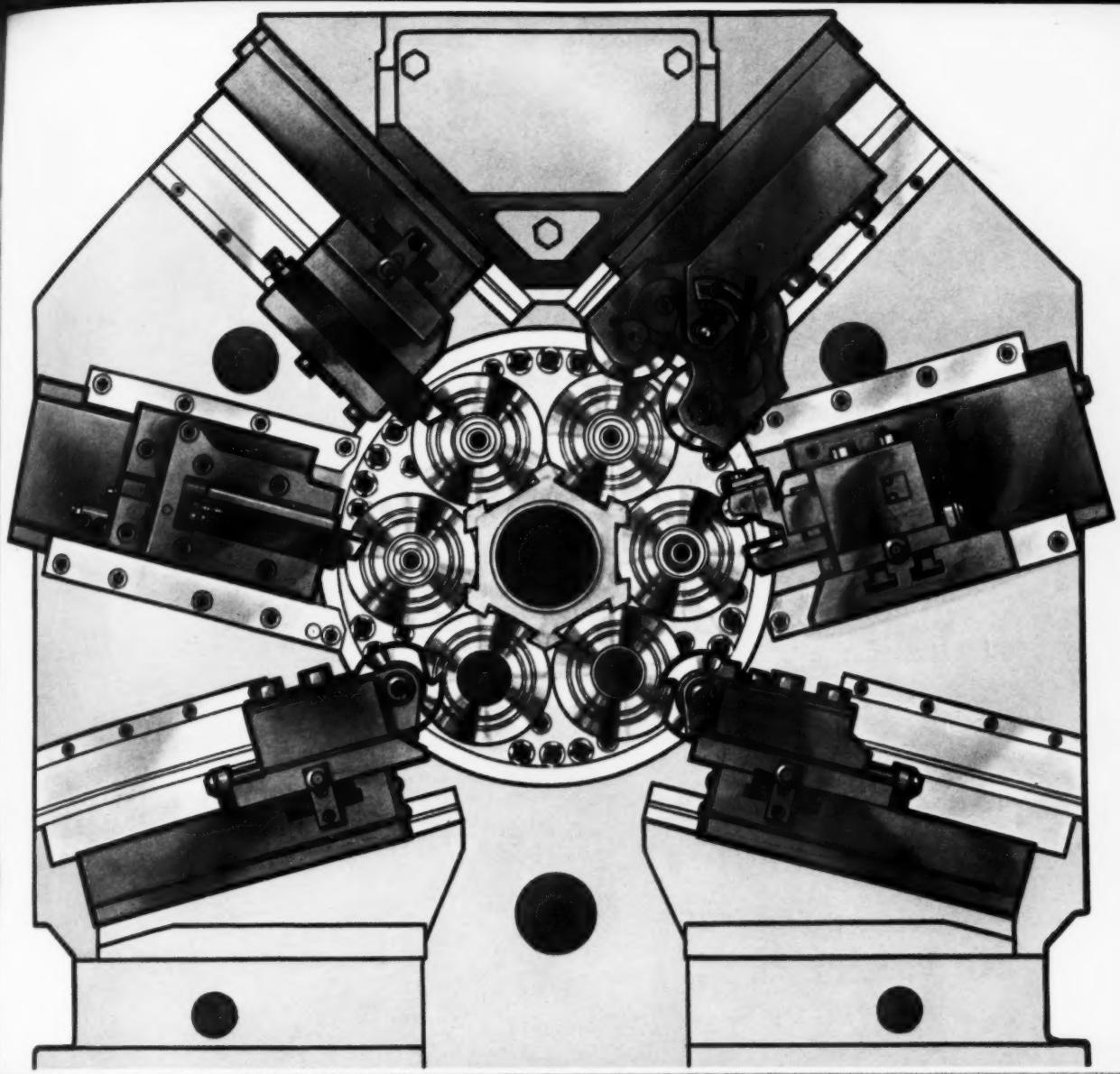
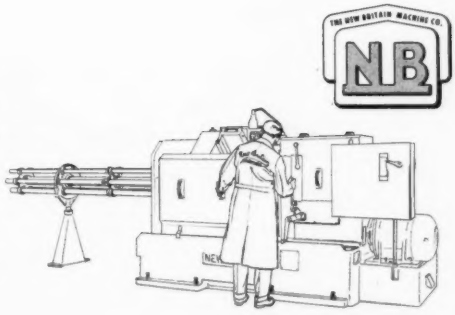
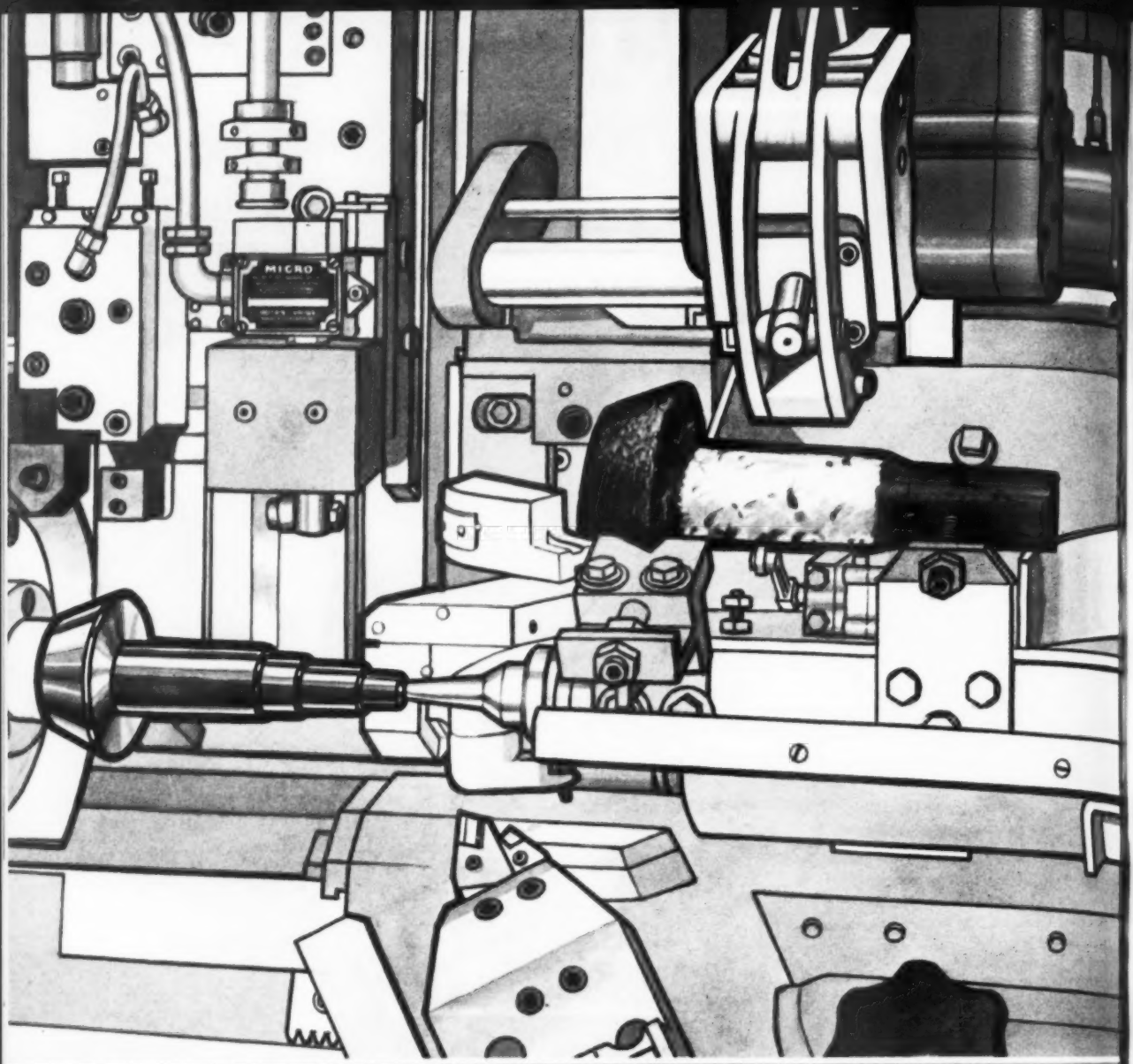


six spindles — six cross slides

Here you see the possibilities for new flexibility of bar machine set-ups with *a cross slide in every position.* Six independent cross slides. More operations on one bar machine. Six independent radial cross slides for forming, roll threading, shaving, skiving, angular facing, knurling, hobbing and undercutting with simpler tools and attachments, through the use of cross slides. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



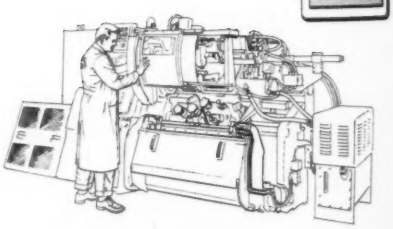
Automatic Bar Machine



no hands — no headaches

Automatic loading of forgings, bar slugs and bar stock is a basic optional design feature of New Britain **+GF+** Copying Lathes. It saves labor and makes a substantial reduction in production time per piece.

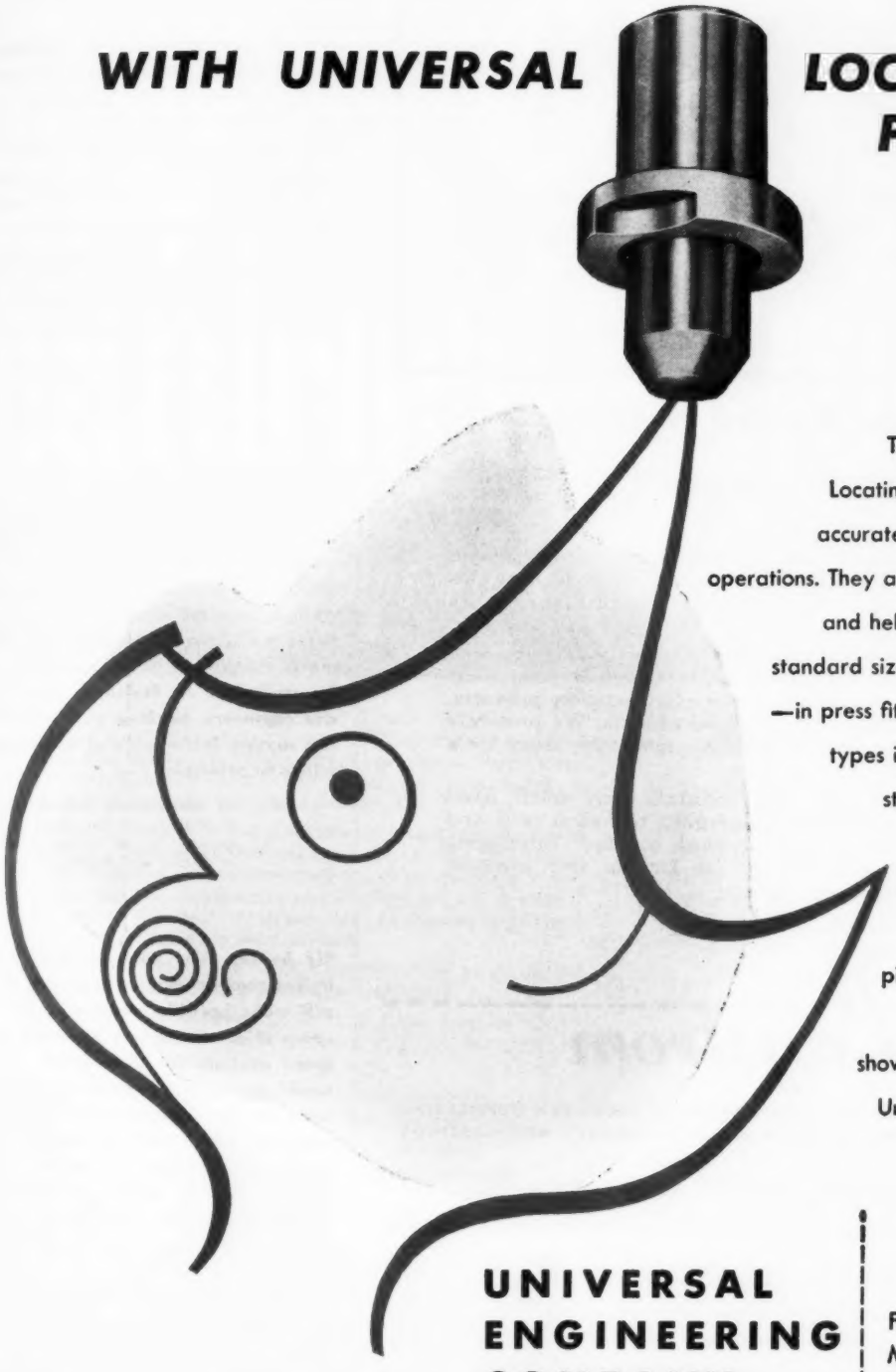
Positive, accurate loading, single point tooling and template control mean fewer headaches and larger profits on your lathe work. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



New Britain **+GF+** Copying Lathe

locate RIGHT ON THE NOSE!

WITH UNIVERSAL LOCATING PINS



The accuracy of Universal Locating Pins assures you quick, accurate alignment in production operations. They are hardened and ground and held to close tolerances. All standard sizes—of round or relieved —in press fit, threaded or lock screw types including rest buttons are stocked and available for immediate delivery at a fraction of the cost of ordinary tool-room pins. Write today for new 98 page catalog showing the complete line of Universal quality products.

UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH 8, MICHIGAN

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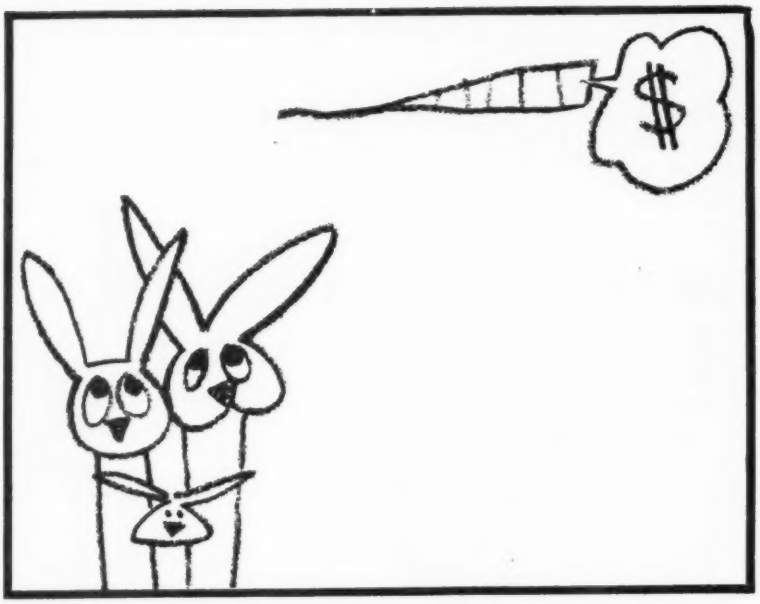

customer problems that *Laystrom* solves *

Low production is bad enough. Then load on high costs and you've got a man-sized headache. Many companies face this problem because overhead is like Ole Man River—it jes keeps rollin' along.

Now Laystrom may be able to help you solve this problem. We can meet your production needs on either component parts, complete parts assemblies, or even complete products. Our plant is geared up for this kind of work. We presently are manufacturing several complete machines, from tools and dies to the finished product.

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**Low production—high costs . . .*

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TOOLS • DIES • ASSEMBLIES • PARTS DESIGN • SHORT-RUN DUPLICATING
PRECISION MACHINING OF MEDIUM SIZE STAMPINGS AND CASTINGS

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• Please send us complete brochure covering Laystrom production services to industry.

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Title_____
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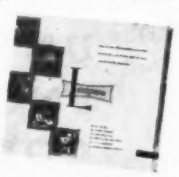


☐ We are sending drawings for quotation. ☐ Have salesman call. ☐ Send brochure only.

CIRCLE INFORM-A-GRAM KEY NO. 42

"Commendable Comments"

"Management duties can be classified in several ways, but the one I like best classifies them in two categories: 1. The technical or mechanical acts of management — issuing orders, signing requisitions, making plans, assigning work, discipline, etc. 2. The 'spiritual' acts of management with employees— building morale; developing intelligence, sound thinking, enthusiasm, and good attributes; and maintaining a personal interest in each employee."

—Joseph A. Anderson, general manager of General Motors' AC Spark Plug Division, at a meeting of the Eastern Air Lines Management Council.

"To sell science to high school students as a career, you first need to sell science to the students' teacher. If a high school instructor teaches chemistry only as a job that has to be done, he is not going to be able to instill much enthusiasm for the subject in his students . . . Industrial scientists and engineers, working with teachers, can suggest better ways of illustrating scientific principles . . ."

—Dr. Urner Liddel, National Science Foundation, at the past meeting sponsored by the National Academy of Sciences and Hughes Aircraft Co.

"If by the year 2000 we have controlled nuclear aircraft reactions, they will make possible photonic rocket or space ships which may approach the speed of light in outer space. This would put us in a position to examine some of the paradoxes of Einstein's equations which indicate that as man goes into space, approaching the speed of light, he gets smaller and smaller, heavier and heavier, and his life process slows down so that, theoretically, he might go into space for a day of his own experience and on his return find that 1,000 years of life had elapsed."

—H. J. Rand, president, Rand Development Corporation, at the dedication of the new Cleveland Engineering Society Building.

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

SHAFTS, ROLLS, GUIDE RODS and other long-round parts

60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

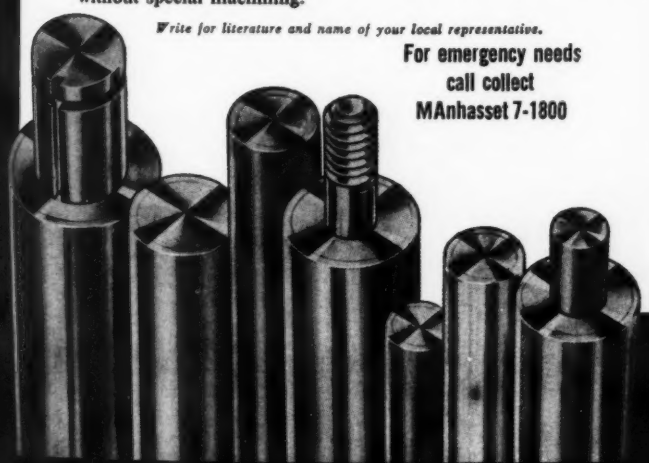
The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.

Write for literature and name of your local representative.

For emergency needs call collect MAnhasset 7-1800



ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

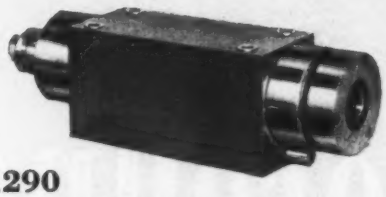
TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

THOMSON INDUSTRIES, Inc.
Dept. C1, Manhasset, New York

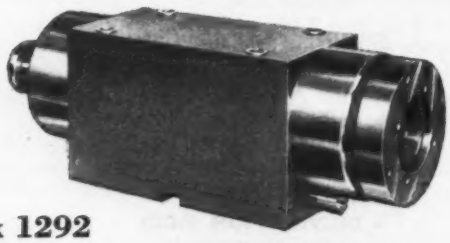
PARKER SPINDLES

FOR PRECISION BORING, MILLING AND GUN DRILLING APPLICATIONS

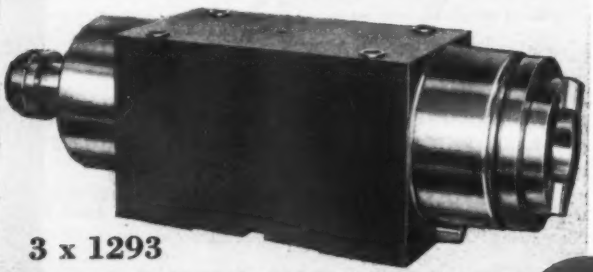


3 x 1290

3 x 1291



3 x 1292



3 x 1293

Versatile—Economical

NO BETTER REASON for the success of Parker-Majestic in the design and manufacture of machine tool equipment can be found than in the acceptance of its versatile 3x1290 series of standard boring, gun drilling and milling spindles.

●

FOUR BASIC BODY SIZES, with modifications of spindle shaft and bearing design, make possible more than 75 spindles, for almost any application in which spindles are used, with speed ranges from a few RPM up to 10,000.

●

YOUR CHOICE OF SHAFTS: 1. Flange head, no shaft hole; 2. Flange head, shaft hole with rear I.D. threaded for rotary coupling; and 3. Milling machine taper head with shaft hole for draw bar.

●

MILLING MACHINE TAPERS are No. 30, 40 or 50, depending upon size of spindle.

●

DESIGN STANDARDIZATION gives you advantages of economical prices, prompt delivery.

●

WRITE TODAY for complete information, giving application, material, finish required, amount of stock to be removed. Also send part print, if possible.

PARKER-MAJESTIC PM PRECISION MACHINES

147 Joseph Campau • Detroit 7, Michigan

M&M blades assure

less cost per cut

MOTCH & MERRYWEATHER offers every user of slitting, slotting and cut-off blades three outstanding cost-saving advantages.

First, M&M's Triple Chip sawing method enables you to take "bigger bites" at higher speeds. Distributing cutting strain evenly, it greatly lengthens tool life.

Second, factory repair, resharpening and resegmenting service, the fastest in the industry, minimizes costly downtime . . . reduces your investment in inventory.

Third, Motch & Merryweather manufactures a *complete line* of cutting blades to meet every circular sawing requirement. Buying all your blades from a single source—your local M&M dealer—saves valuable purchasing manhours, assures consistently high quality blades. Call him today.

FREE—*Send today for your copy of M&M's Circular Sawing Handbook, a pocket-sized guide to sawing operations.*

Q *Quality*
Service
A *Availabilty*

MOTCH AND MERRYWEATHER

Cutting Tool Manufacturing Division
Cleveland 17, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 45

Coming Events

Sept. 29-Oct. 3. National Screw Machine Products Association. Annual Fall Membership Meeting. Broadmoor Hotel, Colorado Springs.

•

Oct. 3-4. National Quartermaster Association. 10th Annual Convention. San Francisco, Cal.

•

Oct. 5. American Production & Inventory Control Society. Charter Meeting. Hotel Cleveland, Cleveland.

•

Oct. 6-8. Fluid Controls Institute Inc. Fall Meeting, Rye, N. Y.

•

Oct. 7-9. American Society of Mechanical Engineers-American Society of Lubrication Engineers. Joint Conference on Lubrication. Royal York Hotel, Toronto, Canada.

•

Oct. 7-9. 13th Annual National Electronics Conference. Hotel Sherman, Chicago.

•

Oct. 9-11. Gray Iron Founders' Society, Inc. 29th Annual Meeting. Drake Hotel, Chicago.

•

Oct. 10-11. National Noise Abatement Symposium. Sherman Hotel, Chicago, Ill.

•

Oct. 10-11. The Society of the Plastics Industry, Inc. 13th Annual New England Section Conference. Commodore Hotel, New York.

•

Oct. 13-17. Pressed Metal Institute. Annual Meeting. Castle Harbour Hotel, Bermuda.

•

Oct. 14-18. International Industrial Development Conference. Fairmont Hotel, San Francisco.

•

Oct. 14-18. International Industrial Development Conference. Fairmont Hotel, San Francisco, Cal.

•

Oct. 17-18. 13th National Conference on Industrial Hydraulics. Hotel Sherman, Chicago.

•

Oct. 21-23. Power Division of American Society of Mechanical Engineers. Conference. Americus Hotel, Allentown, Pa.

Oct. 21-25. National Safety Council. 45th annual Congress and Exposition. Chicago, Ill.

•

Oct. 23-25. National Machine Tool Builders' Association. Annual Meeting. French Lick, Ind.

•

Oct. 24-25. Armour Research Foundation of Illinois Institute of Technology. Fourth Annual Computer Applications Symposium. Hotel Sherman, Chicago.

•

Oct. 24-25. Engineers Joint Council and Engineers' Council for Professional Development. Engineers' General Assembly. Statler Hotel, New York.

•

Oct. 24-26. National Management Association. 34th National Conference and Annual Meeting. Penn-Sheraton Hotel, Pittsburgh, Pa.

•

Oct. 28-31. Atomic Industrial Forum. 1957 Trade Fair of Atomic Industry. New York Coliseum, New York City.

•

Oct. 28-30. Atomic Industrial Forum. Fourth Annual Atomic Industry Conference. Plaza and Waldorf-Astoria Hotels and New York Coliseum, New York City.

•

Oct. 28-31. National Industrial Packaging & Handling Exposition. Convention Hall, Atlantic City, N. J.

•

Oct. 30-31-Nov. 1. Industrial Management Society. 21st Annual Time and Motion Study and Management Clinic. Hotel Sherman, Chicago.

•

Nov. 2-8. American Society for Metals. Second World Metallurgical Congress and 38th National Metal Exposition and Congress. International Amphitheater, Chicago.

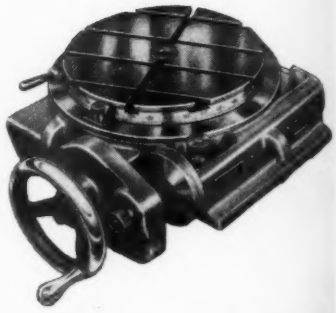
•

Nov. 13-15. American Standards Association. Eighth National Conference on Standards. St. Francis Hotel, San Francisco.

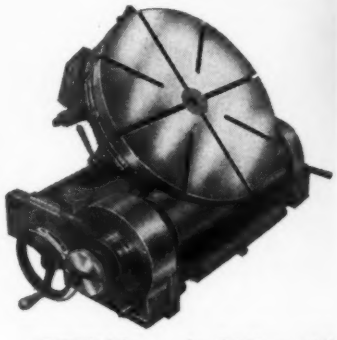
•

Nov. 18-21. Air Conditioning & Refrigeration Exposition. International Amphitheatre, Chicago.

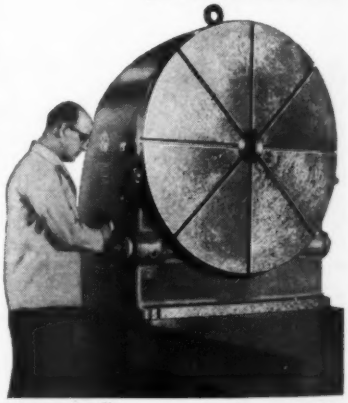
OTHER
PRATT & WHITNEY
PRECISION
ROTARY TABLES



PLAIN . . . in 12" to 50"
12" and 20" diameter hand-operated and 24", 30", 42" and 50" diameter motor driven models. Also available in 42" tables with automatic indexing or with P&W Numerical Control.



TILTING . . . in 10" to 36"
10" and 16" diameter hand-operated and 24"and 36" diameter power-rotated models.



VERTICAL . . . in 30" and 48"
diameters, motor-driven.

PRATT & WHITNEY
15 Charter Oak Boulevard
WEST HARTFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 47

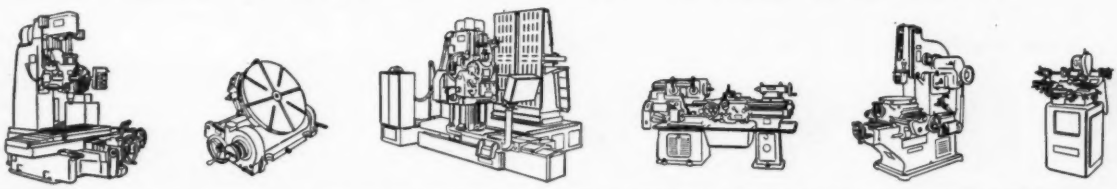
Here's how one company IMPROVED PRODUCT PRECISION and PERFORMANCE

WITH A PRATT & WHITNEY OPTICAL ROTARY TABLE

The high-precision special machines manufactured by the Bodine Corporation of Bridgeport, Connecticut are used throughout the mass-producing industries to process small parts. The heart of every Bodine machine is the "dial" which requires from 20 to 200 accurately bored holes arranged in from 10 to 36 stations. To improve the precision of this critical component, the Bodine Corporation recently purchased a new Pratt & Whitney 24" Optical Rotary Table. As a result, tolerance between stations on the dial has been cut from 15 seconds of arc down to just 3 seconds and, as a spokesman for Bodine Corporation has stated, "... the improved efficiency of our product is obvious!" In addition to this table's greater accuracy, Bodine also likes the easy-to-read optical screen that cuts down on operator fatigue and the fact that constant use produces absolutely no error from wear.

If any of your own machining, inspecting or calibrating operations require extremely accurate circular spacing or angular positioning, it is more than likely that a Pratt & Whitney Optical Rotary Table can help you improve your product's precision and performance.

Write now for complete information.
Pratt & Whitney Company, Incorporated
15 Charter Oak Boulevard, West Hartford, Conn.



JIG BORERS . . . ROTARY TABLES . . . KELLER MACHINES . . . LATHES . . . VERTICAL SHAPERS . . . CUTTER AND RADIUS GRINDERS

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 47

Because Precision Depends on the Measuring System . . . .

SPECIFY PRATT & WHITNEY JIG BORER END MEASURES AND INSIDE MICROMETERS

Jig borers using the "End Measure" system of locating can only be as accurate as the measuring instruments they use. So, to protect your investment in jig boring precision, *insist* on the best in measurement . . . Pratt & Whitney End Measures and Inside Micrometers. Made from selected gage steels, hardened, seasoned and finished in our standard temperature room, they are your assurance of dependable precision that can help you eliminate scrap losses, increase productive efficiency and up-grade product quality and acceptability.

Send now for your copy of Circular 611.
Pratt & Whitney Company, Inc.
15 Charter Oak Boulevard West Hartford 1, Connecticut

. . . THREAD ROLLING DIES • DUOCONE DIES • TAPS • THREAD MILLING CUTTERS • REAMERS . . .

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY
MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 48

Presenting . . . Representing . . .

Scully-Jones & Co. has announced the following distributors for its products: Cutting Tools Inc., St. Louis territory; Oliver H. Van Horn Co., Inc. of New Orleans, the Mobile, Ala., and Jackson, Miss., area; Farquhar Machinery Co., Jacksonville, Fla.; Garrett Supply Division of the Garrett Corp. of Los Angeles, southern California and Arizona; and Schultz Industrial Supply Co. of St. Joseph, Mich., the Benton Harbor area.

•

Birmingham and Conner Machinery Co., Detroit, are representatives in eastern Michigan for Kingsbury Machine Tool Corp.

•

Index Machine Co., Jackson, Mich., is a national distributor for the Adamas upright drilling machine.

•

The Chicago area distributor for the Hamilton Tool Co. is Dvorak Machinery Co.

•

Joseph J. Serra is engineering representative in the metropolitan Detroit area for Huck Mfg. Co.

•

New representatives of the Colonial-Romulus Div'n, Colonial Broach and Machine Co., are E. W. Brock Co., Cincinnati; The Eaton Co., Hackensack, N. J.; and Geoffrey-Lane, Inc., Denver, Colo.

•

George W. Smith Co., of Atlanta will serve as representative for Miniature Precision Bearings, Inc., in Florida, Alabama, Georgia, Tennessee, and eastern Mississippi.

•

The Chagnon Co., Windsor, Conn., is serving as representative in the New England area for the Instrument Div'n of Engis Equipment Co. The Precision Service Co., Skareateles, will serve New York State, except the metropolitan area. They will sell and service optical, electronic, and mechanical gages, tools, instruments, and accessories.

•

The Ernest E. Diener Co., is the sales representative in eastern Michigan for Size Control Co., producers of reversible plain plug gages, reversible thread plug gages, and centerless lapping machines.

•

P. D. Browne Co., is the distributor in Texas for the Michigan Tool Co., and will handle the line of machine tools and cutters.

At Your SERVICE

The new Precision Stud Div'n of Standard Pressed Steel Co. has been set up to produce critical large diameter fasteners of the type required for major structural fastenings in power plant steam turbines, nuclear reactors, chemical process vessels, and other large high-temperature, high-pressure equipment. It also provides designers and builders of power plant equipment with specialized engineering and production assistance to help solve design problems peculiar to this field.

•

Verson Allsteel Press Co., of Chicago offers services which include contract welding, machining, and gear cutting. Their equipment is able to take care of small and large tools, and they have facilities for assembly and shipping. An engineered press rebuilding service is also offered.

•

Orders are now being accepted by Firth Sterling Inc., for induction vacuum melted super alloys. Kolcast Industries Inc., a subsidiary of Thompson Products Inc., is now producing super alloy ingots which Firth Sterling converts into billets, centerless ground, and hot rolled bars. Ingots weighing 500 lbs are now being produced, and in the future 2,500-lbs ingots will be produced in a variety of critical super alloys.

•

A line of stainless steel castings from 1 oz to 600 lbs is being offered by the Alloy Steel Casting Co. of Southampton, Pa. The company has the latest equipment and complete facilities for producing these heat and corrosion resisting stainless steels.

•

Jasson Gage Co. of Detroit makes available a new service, the production of special size gage blocks to customer's specifications. The sizes range down to a thickness of 0.004". Materials include special alloy gage block steel, chrome plated steel, tungsten carbide, cemented carbide, chrome carbide, and other alloys. These blocks can be used for setting up internal measuring machines, setting sine bars, or setting external measuring equipment. Single units or sets of two or more can be supplied.

Because Precision Locating is Only Half the Job . . .

CHOOSE PRATT & WHITNEY JIG BORING TOOLS, REAMERS AND STUB GAGES

While accurate positioning is an essential part of precision jig boring, it's only half the job. Equally important is the ability to transfer the inherent accuracy of the machine to the workpiece . . . and to a great degree, this depends on the cutting tools you choose. Help your jig borer deliver its high-precision potential . . . choose Pratt & Whitney Boring Tools, End Mill Reamers and Stub Gages. Designed and produced by people who know jig borers and jig boring, they have *everything* it takes to put precision to work for you more efficiently and economically.

Send now for your copy of Circular 611.
Pratt & Whitney Company, Inc.
15 Charter Oak Boulevard, West Hartford 1, Connecticut

. . . MILLING CUTTERS • CUT-OFF BLADES • END MILLS • KELLER CUTTERS • KELLERFLEX BURS .

PRATT & WHITNEY

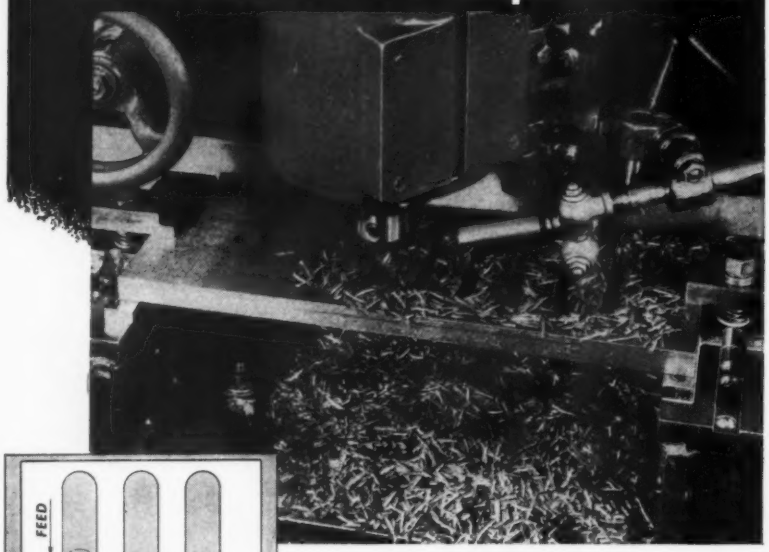
FIRST CHOICE FOR ACCURACY

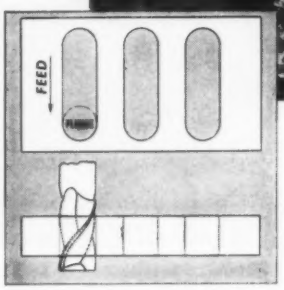
MACHINE TOOLS • GAGES • CUTTING TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 49

Brown & Sharpe CHIPS

End Mills Designed with Economical Chips in Mind





Center cutting End Mill plunges vertically into workpiece. When milling a slot to desired width, metal removal is concentrated on the peripheral teeth.

High Speed Slotting with High Speed Steel End Mills

The cutting efficiency designed into Brown & Sharpe Fast Spiral End Mills is shown by the accumulation of large, uniform chips—your best clue to cutter performance. Even at high speeds, the chips flow smoothly away from surfaces being machined.

Each tooth of a Brown & Sharpe PRODUCTIONEERED End Mill is ground with double-angle lands . . . combines correct relief with increased strength of the cutting edge. Fast Spiral End Mills are especially designed for rapid cutting action, reduced power consumption.

Whether you specialize in long production runs, or perform precision toolroom work, milling cutter efficiency is an important item in your budget. For maximum speed, accuracy —and economy—always specify Brown & Sharpe PRODUCTIONEERED Cutters!

Write for 80 page Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

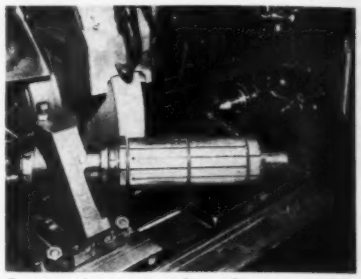
STOCK OF OVER 3000 STANDARD TOOLS!
Obtain impartial High Speed Steel, Carbide and Carbide Tipped tooling recommendations from your Brown & Sharpe-NELCO Distributor.

EXPANDING MANDREL HAS PRECISION AND HIGH PERFORMANCE

Precision mandrels especially adaptable for grinding thin-walled parts such as sleeves and bearings are providing extreme accuracy, rapid loading and unloading, and long life with little maintenance.

One of the users, the International Harvester Company, tooled up three years ago for production grinding of dry liner sleeves for their 181 series engines. The tolerance requirements were: OD within .001"; taper within .0008"; wall thickness, .0015"; and out of round tolerance .0005".

They chose an expanding mandrel built by the Western Tool and Mfg. Company for the job, but the precision requirements plus the need for quick and easy loading and unloading called for special tooling. They were called upon to design a special



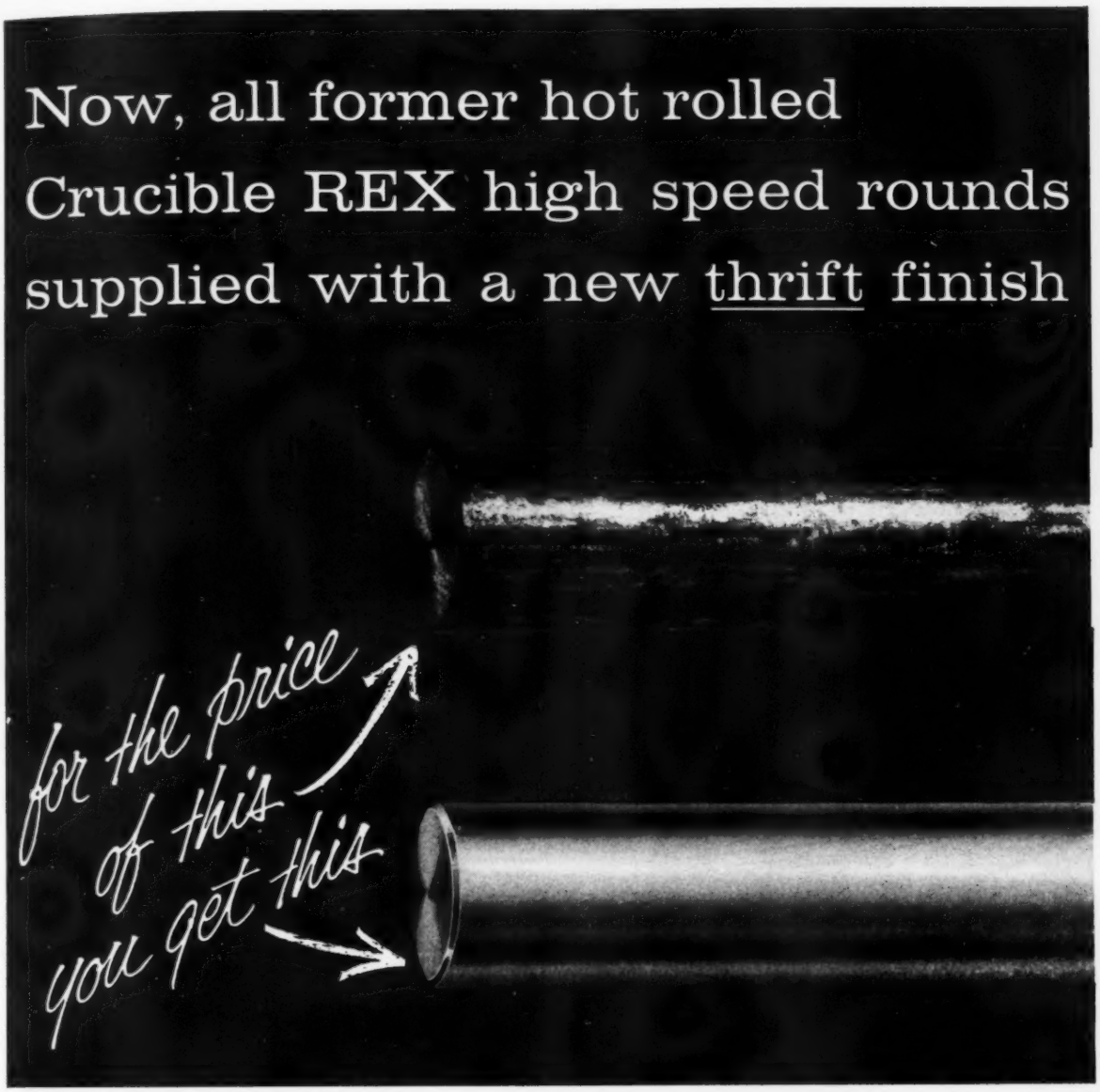
fixture incorporating the expanding mandrel for use on a Landis Grinder. This fixture swings out at an angle from the wheel to enable the operator to slip the sleeve on the mandrel, then expand the mandrel with an open end wrench and grind the piece. To unload, the operator tightens the nut at the driven end of the mandrel to loosen the sleeve. Retaining springs in grooves contract the expanding sleeve so the operator can easily slide the workpiece off.

For three years the mandrel has been operating satisfactorily and has required very little maintenance. Records indicate that the arbor centers are ground about every three weeks to keep the mandrel within the specified .0002" run-out condition. Center inserts are replaced every nine months or so and the mandrel shell is ground down and chrome plated every 18 months.

During the three-year period they have had little trouble maintaining the accuracy required of the dry liner sleeve and the original tools are still in service and performing satisfactorily.

Your Inform-A-Gram Card Is On Page 170.1 In This Issue

Now, all former hot rolled Crucible REX high speed rounds supplied with a new thrift finish



Here's a revolutionary, new Crucible policy designed to provide an improved product—save time and processing costs. Now, Crucible furnishes all REX® high speed rounds from ⅝" up with a machined surface, close to size and free from decarburization. All bars from ¼" to ⅝" round are supplied cold finished.

This new *thrift* finish means important savings to you – whether you've been paying extra for decarburization and stock removal, or grinding or rough turning rounds in your own shop. Of course, where extremely close tolerances are demanded, precise centerless grinding is still available at a small extra.

It's another Crucible "first" that offers you substantially more for your high speed steel dollar. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 51

*Pioneered by Covel and first introduced at the 1947 Machine Tool Show. Available on all Covel surface grinders.

Save Re-scraping...Save Money! with COVEL HARD CHROME TABLE WAYS*

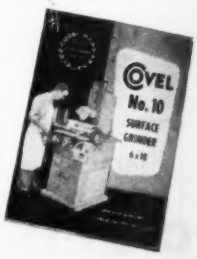
COVEL No. 10 SURFACE GRINDER

6"x18" Hand or Power Feed

Engineered to give you the most accurate gage, form tool and surface grinding performance at *low initial cost*. Smooth timing belt drive, hardened and ground lead screws and rigid vertical slide insure precision operation.

Hard Chrome Table Ways Reduce Maintenance Costs

This Covel introduced feature preserves the built-in accuracy of hand-scraped ways for extra years of precision service.



COVEL PRECISION GRINDERS
BENTON HARBOR, MICHIGAN

Write for FREE BULLETIN

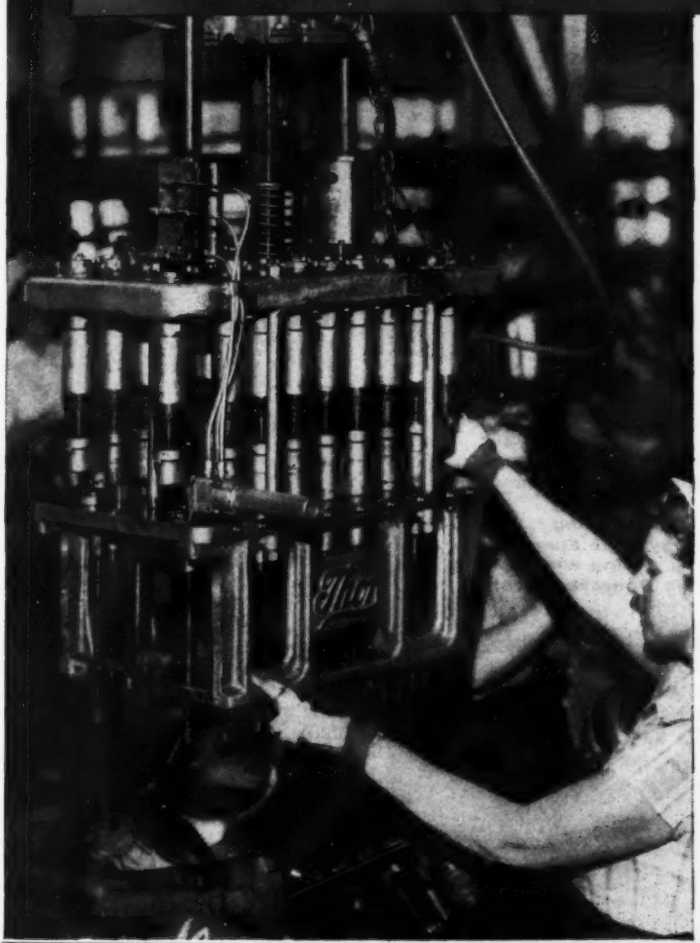
For all the facts about the rugged low cost Covel No. 10 write DEPT. TP-107

THE MOST COMPLETE LINE OF SURFACE GRINDERS • UNIVERSAL CUTTER & TOOL GRINDERS • DRILL GRINDERS • OPTICAL COMPARATORS

CIRCLE INFORM-A-GRAM KEY NO. 52

If you run two or more fasteners at the same time—cut costs with

THOR MULTIPLE NUTSETTERS AND SCREWDRIVERS



Now, thanks to Thor multiple nutsetters and screwdrivers, the largest to the smallest assembly operation can enjoy the cost cutting benefits of automation. If you have production assembly jobs involving 2 to 20 or more nuts or screws, Thor multiples can return their cost in labor savings, in improved quality control, time and time again.

Running multiple fasteners at one time means every fastener is tightened to identical torque simultaneously with no shift in tensile load equilibrium which occurs when fasteners are tightened one at a time.

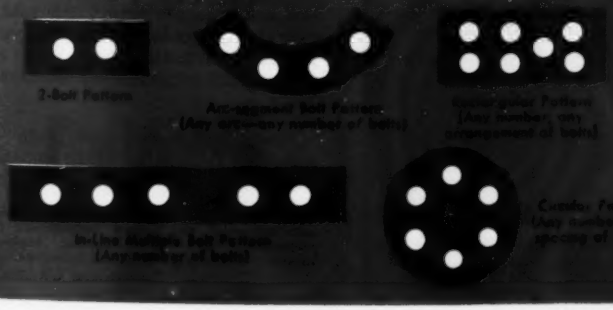
For the complete story of how Thor multiples can help you, write today for Thor's free book "Automation in Assembly." Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.

THOR POWER TOOL CO., CHICAGO

Branches in all principal cities

Thor PORTABLE POWER TOOLS

Thor multiple tools can be custom-built to any pattern, any number



FREE

AUTOMATION MANUAL ON MULTIPLE FASTENER SETTINGS

Pictures, diagrams, all the facts

NAME_____

TITLE_____

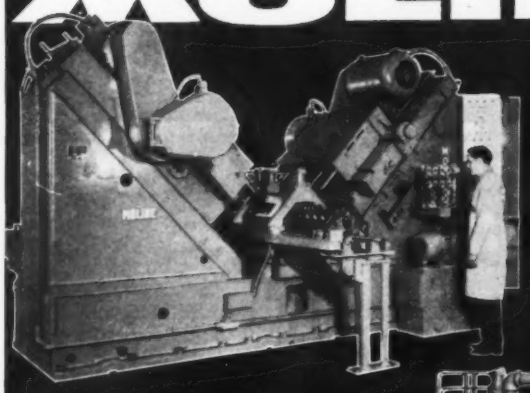
COMPANY_____

STREET_____

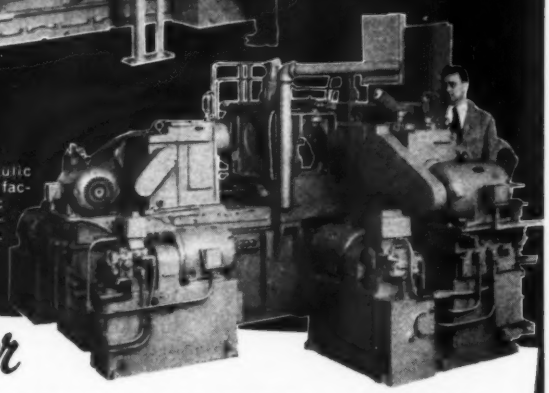
CITY_____ ZONE___ STATE_____

CIRCLE INFORM-A-GRAM KEY NO. 53

MOLINE



No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.



MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

For Greater

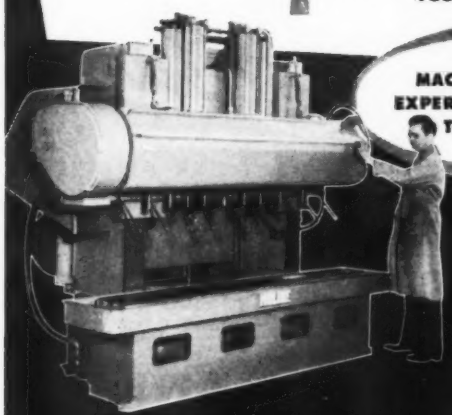
PRODUCTION . . . EFFICIENCY . . . SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as...

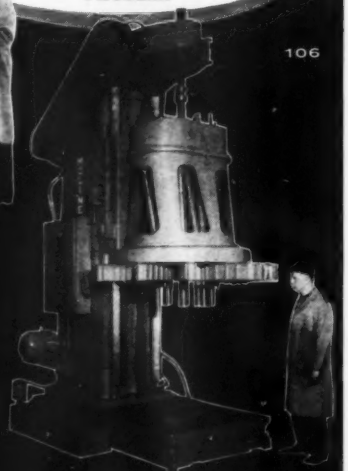
- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

OVER 55 YEARS OF MACHINE TOOL ENGINEERING EXPERIENCE IS AT YOUR SERVICE. TELL US YOUR PARTICULAR PROBLEM

106



HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.



No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.

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CIRCLE INFORM-A-GRAM KEY NO. 54

Talk of the Month

INGENUITY, INSPIRATION, AND IMMORTALITY

by Charles F. Kettering

Research Consultant
GENERAL MOTORS CORPORATION

IT'S ABOUT 105 YEARS since the first engineering society was formed — that was the Society of Civil Engineers. Now, the word "civil" doesn't quite express it. The only reason they were called civil engineers was to differentiate them from military engineers, and they were our first engineering people. Now the word engineering has changed in what it means. It used to be an engineering word for something that was permanent. To be a good engineer now you make something so that it depreciates very rapidly and you have to buy a new one!

This Engineering Society Building is a very important thing in many ways. It will help us get out of a "Tower of Babel" which has gotten into our engineering and technological societies, because if you belong to one of these societies and you make a speech and everybody could understand everything you said, that's bad!

I recently gave a talk — a commencement address — three or four years ago at Michigan State, and the president said to me, after it was over, "Ket, that was the lousiest address I ever heard." He said, "Everybody understood what you said. It would be a perfect commencement address if the president of another university comes here and makes a talk and the local president can't understand a word he says. That is one hundred per cent." He said, "If everybody understands everything you say that makes it the worst commencement address ever delivered."

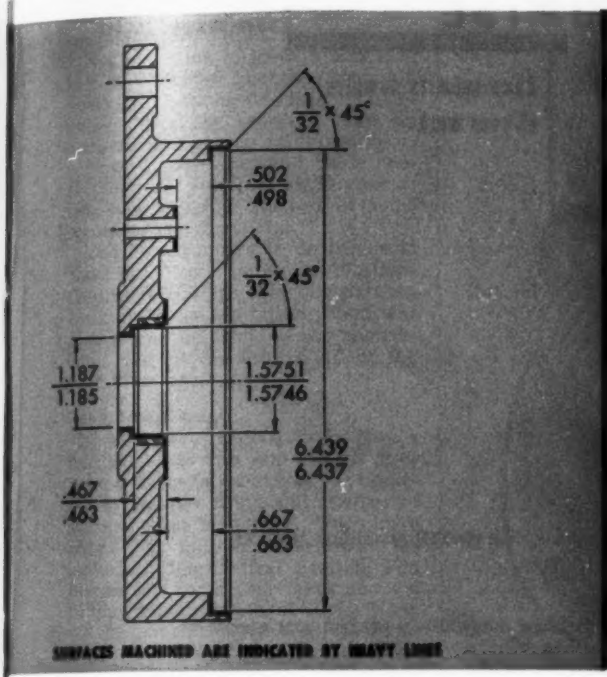
Use English

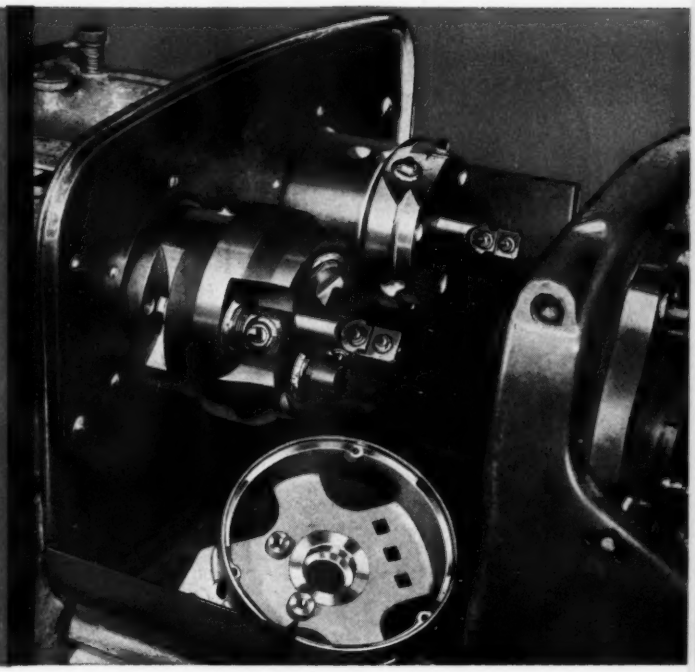
Now, we sometimes pride ourselves on being able to say something that sounds a little better than it is.

Presented by "Boss" Kettering at a civic luncheon following the recent cornerstone laying ceremonies for the Cleveland Engineering Society's new Engineering and Scientific Center.

. . . Continued on page 57

9 surfaces rough and finish machined in 2 passes...





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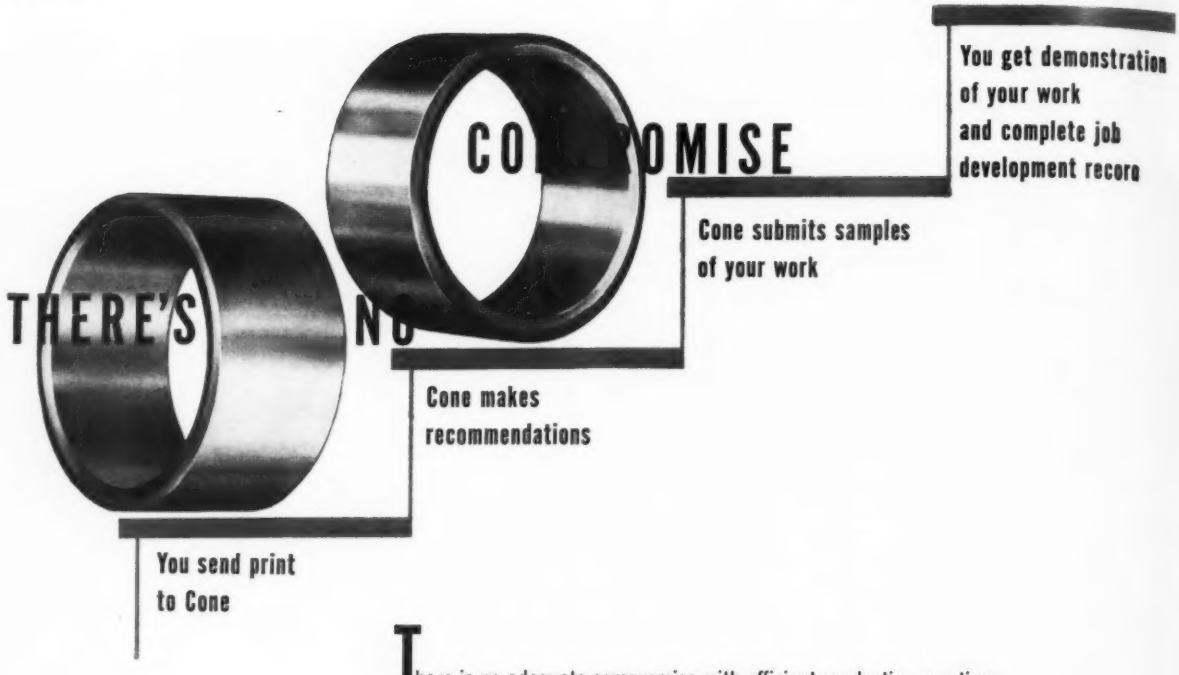
No. 6 in a series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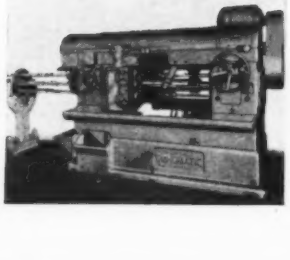
But you don't always know just how competitively efficient your equipment is. Case histories of what the other fellow is doing are sometimes garbled. At least the poor ones are not advertised. And conditions vary in all plants. Sometimes you have reason to be more concerned with what you don't want in new equipment than with what you do want. Cone believes too much is at stake for a machine to go into a line unequipped for the job, with either carbide or hss tools.

The Conomatic Carbide Development treats each job individually from standpoint of work, machine, tools, and operating personnel.

DATA FOR COMPARISON

Part.....Bushing	Length.....⅝"
Machine.....1⅝" Conomatic	Hole Dia.....1¼"
Tools.....100% Carbide Tipped	RPM.....825
Material.....8620	Time.....14.8 Secs.
Stock Size.....1⅝"	



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CIRCLE INFORM-A-GRAM KEY NO. 56

. . . Month's Talk from page 54

Therefore, if you know a lot of Latin and Greek synonyms, you can get along pretty good. You know, someone here mentioned this chlorophyll business — see, chlorophyll is just the Greek for green leaf — and we don't know any more about it in Greek than we do in English. But somehow people think they do!

Now, learning to speak a language is very important, because after all, everybody that is working in technology is really working only on material and energy relationships.

Now, I hope this will be a "defrother" and you'll speak English in this new building instead of some technological shorthand.

The opportunities to do things in these fields are perfectly limitless. One of the things that our particular industry — I'm talking about the automotive industry — has contributed, I think, is getting rid of the fear of change.

Don't Fear Change

E. G. Bailey made a study here a few years ago and sent me his findings, of the relative size of the horsepower and one thing and another of some of these industries. They have about 125 million horsepower installed in the Central Station, and to run that for a year takes about a billion dollars worth of fuel. Now, we have about 60 million automobiles on the road and this depends on who wrote the advertising as to what the horsepower is. And we spend 15 billion dollars a year for fuel to run those. If we even take the word of a low-grade advertising manager, we have about 9 billion horsepower, or so, that you have on the road. Now, that industry is quite an industry. It used to be you had food, clothing and shelter, and then as civil engineers started up, we had transportation, and the telegraph-telephone communication and then later on, entertainment. Those were the most important industries we had. But our industry is the transportation industry. We have about 60 million cars. There are five seats to a car — that's three hundred million seats we've got, and we have about 160 million people. So we have quite a few seats left over, until we can take every one in the United States — every man, woman and child — and we could take all of England, France, Italy, Spain and Portugal for a ride at the same time. Now, a great many people think we do that every year! But it isn't so.

I used to hold engineering meetings when I was running General Motors Research, and I had at the door of the little auditorium a card table with a black velvet cover on it. I used to have a little sign on that, "Leave your slide rules here." Now, the reason for that — I'd get up and relate a little problem I was working on and some guy would stick his

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CIRCLE INFORM-A-GRAM KEY NO. 57

hand in his pocket and pull out one of these slide rules and work it and say, "Boss, you can't do that." I knew they couldn't multiply mentally, that was out of the question! As long as they didn't have those slide rules they would have to believe it could be done until they got back to the slide rule.

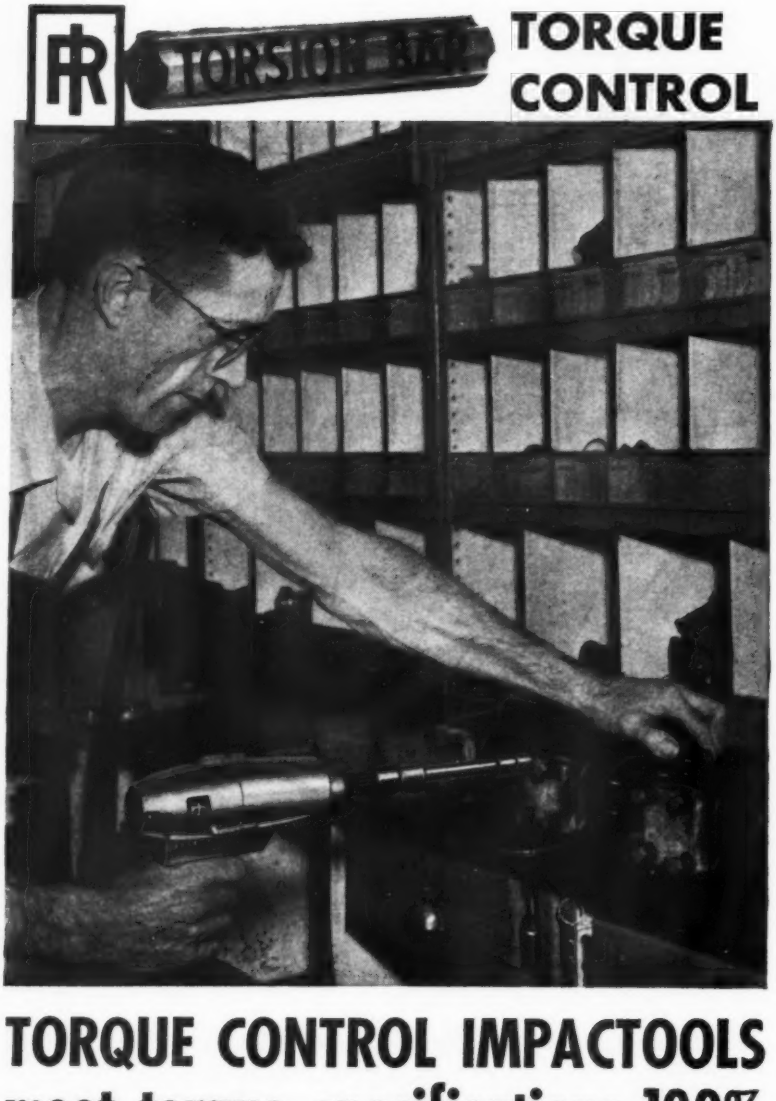
You'll find, in building this new engineering center, that there is nothing as difficult in the world as doing any new thing, I don't care how simple it is. And a great change is taking place in engineering. People are building for long periods instead of something that will satisfy the progressive tone of the community in which you live. Whether it's a building, whether it's a bridge, whether it's a power station, or what not, these things change, and the unfortunate thing about a lot of our thinking is that we forget that tomorrow is another day. That's the whole hazard of being an engineer.

A Place For Tomororw

The obsolescence factor of tomorrow is one of the great things you have to battle against. That's the reason why you shouldn't read too much history — that's a very dangerous thing. You know, I want to put over the door of the library READ HERE AT YOUR OWN RISK! because you get more misinformation than you can correct information. When you open this building — when you dedicate it — you're opening up a place where tomorrow at least can have a seat. Most people are always looking back . . . Where did we come from? I don't think you should be so worried where you came from. Where are you going? You know, I expect to spend all of my life in the future!

We know so very little. In our engineering schools we're getting back to the idea now of more general education instead of specialization. To be a specialist is a very comforting thing, because you can say "this is out of my line!" It's one of the cleverest ways of avoiding responsibility that I know of. But if you haven't got somebody that's taking a look at the whole picture — and that's what you are going to be able to do over there — the technological front — you ought to have a big blackboard where you put the technological front which everybody has to be responsible for. I have some great faith in what the engineers can do (if their bosses will let them). You know, we're not bad here at all in this center, that's the reason why I'd like to see the engineer part of management, and I think it would be to the advantage of a great many managers to have them all because they could spread the responsibility for the mistakes that are made.

The recognition of what the whole problem is . . . is one of the great contributions of the auto industry in



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addition to its transportation. One of the greatest problems we have, I think, could be solved if we could get the newspapers working with the engineers. They can tell the engineers where they're wrong, and I'd like to have the men in our group tell us where we're right.

But with better roads we have good telephone communication now. When Dr. Guild was chief engineer of the Bell Telephone Company, he came to me with a news item, and he said, "We've got just about as many telephones as we've got automobiles." "Well," I said, " all that proves to me is that you can drive over as quick as you can call!" But the telephone has improved tremendously. So have a great many other things in industry.

This question of communication, being able to talk with somebody, I have a little story that I used down in Texas this spring when I was down there at the Southwestern Refiners Association, and while I'm not an oil man (for which the oil people are very thankful), after being in Texas in San Antonio, I had to have a little Texas story. I say the nearest to the Texas story I have is in this field of communication where people don't understand even simple words. There was an oil man down there that was quite sick — he was going around to all the specialists and they all told him the same thing, "Now you can't live very long, better get your affairs in shape, because you're like to drop off just like that!" So he had been in school with a fellow who was a country doctor now, in this small town, and he said he'd gone up to see the doctor. And the doctor said, "Joe, I think there's been a mistake in the diagnosis of your case," he said. "I don't think it's that bad; we have a little hospital here, we'll put you in the hospital for a few days," and he said, "no, he says, they're mistaken about that;" he says, "you're all right," he says, "you go back home and go to work." And Joe said, "Well, Doc, how much do I owe you?" "Well," he said, "what the hospital did and everything it comes to about a thousand dollars." "Oh, no," he says, "you saved my life. Isn't there anything in the world you'd like to have?" "Yes," he said, "I'd like to have a set of matched golf clubs." The oilman said, "I'll get them for you." So he left. The doctor didn't hear anything from him for months and months and months, and one night, he called up and says, "Hello, is this you, Doc?" He says, "Yes." The oil man says, "Gosh, I've had a hell of a time getting those golf clubs. I've got eight of them, but they're not too well matched, two of them haven't got swimming pools!" And it's not hard to see how a man in that state of mind could make that mistake.

(Continued on next page)

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CIRCLE INFORM-A-GRAM KEY NO. 59

We Can Do Anything

But, so far as the future of engineering and technology in our country is concerned, let's not let anybody talk us out of it. I've heard these people talk about the many more engineers the Russians have got than we have, and if they've the kind of engineers that I think they have, I wish they had a lot more of them! We can do things there, whether you're an engineer or whether you're just a technician. You've got all these automobiles and all these radios, all the telephones, all the television sets. All of this material technology is being operated very satisfactorily and if we had the programs equal to that, we'd have a wonderful thing!

This country can do anything, technologically; show them a little bit and they'll go ahead and do it. This engineering society is a center for all technological things. A man came to me one time and he said, "You need a central information point for technical people in the United States," and he said, "you haven't got one." I said, "Who said so?" I said, "You name the kind of fellow you'd like to get a hold of and let me show you how the thing works." Well, he told me what kind of a fellow he wanted and it happened to be in the field of mechanical engineering. So I just took down the telephone and called the Society of Mechanical Engineering in New York, and in less than ten minutes, he was talking to the best man in the United States on that particular subject. Who says we don't have a clearing house?

Now, these societies like you're setting up here make that thing even faster, but we must remember this: that whatever we have today, whatever this group builds today, whatever your plans are, it will be a little bit out of date before we get into it. And we can't help that, because you can't finish it instantaneously. Tomorrow will be another day! And, they say, have we got this to do over again? But if you have to do it over again, you make the same kind of mistakes.

We have two air fields down in Miami, one a civilian air field and the other commercial, and they're building a new administration building at this civilian airport. A taxi driver had just read in the paper the day before that they were going to stop putting up the steel for it because the thing was going to be out of date before they got it done. And he says, "That won't make any difference, I think it's a mistake to stop it, because by the time they talk it over in the city government and all that kind of stuff, it'll take them three or four years before they get another plan, and before they get the steel ordered and up then, that one will be out of date." He said, "Do 'em quick! and then fix 'em after you get 'em up. Because, if you try to have everything 'the last word' you'll never get 'em finished!"

But, remarking about things getting out of date, Dave Dietz was talking this morning in that magnificent resume he made of the possibilities of the future, about atomic energy. Well, now, I don't know what you can do with atomic energy. It's a wonderful thing for magazine writers and editorial writers, because nobody knows anything about it and so that gives you a free hand. That's what you call "freedom of speech," you know. But just the common, ordinary things that we need — there's a million of them that we need to be doing all the time everywhere. There's improvement in lighting, we need that every place, and, besides, that helps General Electric sell lamps, and that's a good thing, see?

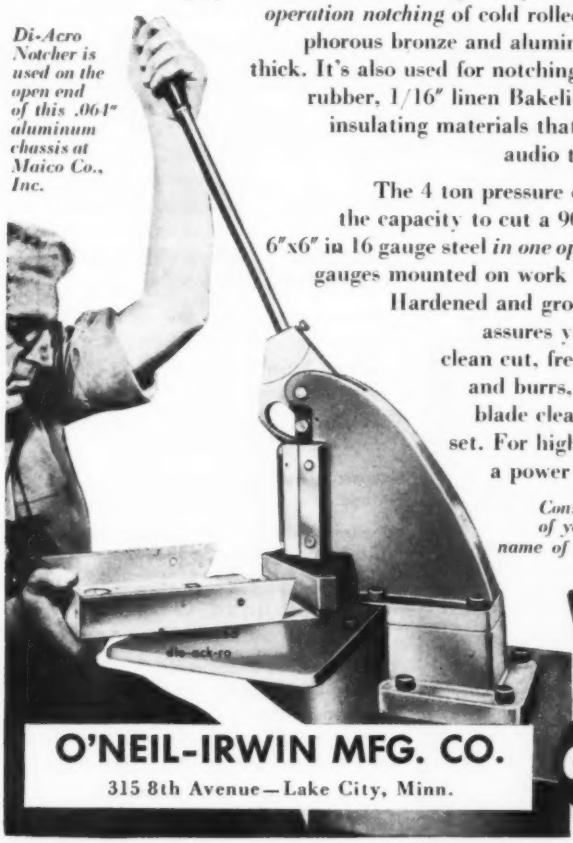
Double Profit System

We're continuously improving everything and should be. You know, we have these surpluses of food stuffs today. Well, now I don't know whether you know what the cause of that is. In the last twenty-five years, we've taken about 20 million horses off the American farms, and these surpluses are simply the feed for those horses.

. . . *Continued on page 64*

DI-ACRO*NOTCHER Speeds Production, Saves Extra Operations on Chassis Work

"I use our Di-Acro Notcher for practically everything," says V. Johnson of Maico Co., Inc., Minneapolis manufacturer of hearing testing equipment. "This machine speeds production—*provides one operation notching* of cold rolled steel, brass, phosphorous bronze and aluminum up to 16 gauge thick. It's also used for notching fish paper, sponge rubber, 1/16" linen Bakelite and other circuit insulating materials that go into chassis for audio testing equipment."



Di-Acro Notcher is used on the open end of this .064" aluminum chassis at Maico Co., Inc.

The 4 ton pressure of this machine has the capacity to cut a 90° notch as large as 6"x6" in 16 gauge steel *in one operation*. Adjustable gauges mounted on work table are standard. Hardened and ground triangular ram assures years of precision. A clean cut, free from rough edges and burrs, is possible because blade clearance can be easily set. For high speed production, a power model is available.

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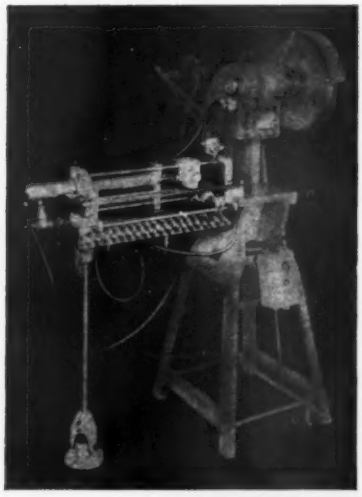

Left: ASF-12 U. S. Air-Operated Slide Feed used in conjunction with small OBI Press. On light work requiring long pitch or feed length, this type of Feed can be used with presses much smaller than would ordinarily be required.

Gain all the advantages from the use of coil stock in your Press Room by arranging your presses with automatic equipment. The illustrations show just a few of the many units included in the line of U. S. Automatic Press Room Equipment designed and built to aid you to reduce costs and increase production. Every operation eliminated will increase your profit potential and place you in a more favorable position in today's competitive market.

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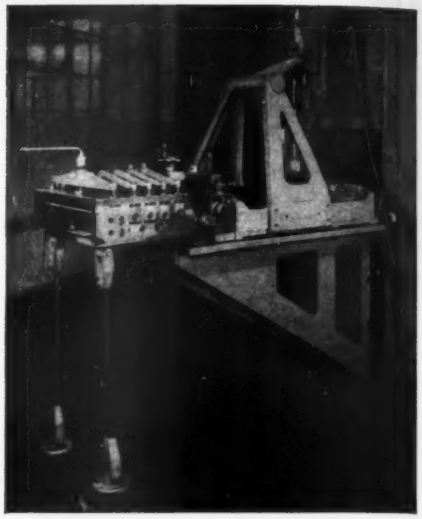

Above: SF-24-24 U. S. Slide Feed equipped with Plain Straightener mounted on Straight Side Press. Capacity for material up to 24" in width, feed length adjustable up to 24" per stroke. Same type of Feed made in smaller sizes.

U. S. TOOL COMPANY, INC.

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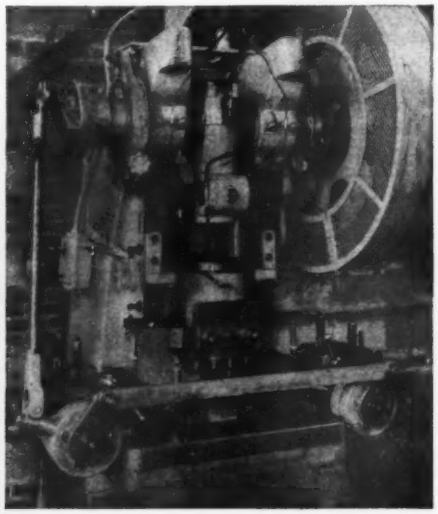
Below: SFC-24-24 U. S. Cabinet-Mounted Motor-Driven Slide Feed equipped with Plain Straightener. Capacity for material up to 24" in width, feed length adjustable up to 24" at one stroke. Equipped with counter to permit multiple stroking to obtain longer lengths.



Left: U. S. Double Roll Feed (push-pull type) mounted on conventional OBI Press. Direction of feed can be either right to left or left to right. Made in range of sizes.

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only Vlier HEXNOSE spring plungers can be installed with an ordinary end wrench!

Hexagonal nose eliminates need for spanner-type wrenches; speeds insertion, adjustment and removal!

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Since the plunger nose is always easily accessible, the Hexnose really pays off where periodic adjustments must be made. Hardening both body and plunger assures body life. Available in both standard and light end pressure models; 11 sizes.

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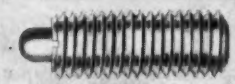

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For use with aluminum, brass and other soft materials.

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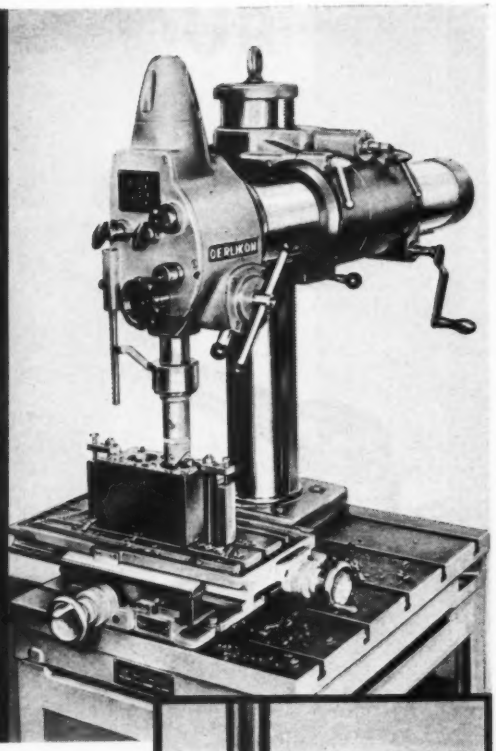

The UB 2 performs hundreds of general and specialized workshop operations—drilling, milling, countersinking, tapping, precision and center boring, reaming, facing, trepanning, etc.

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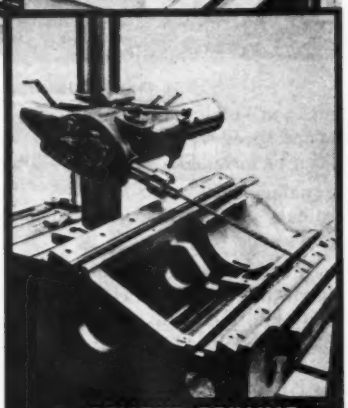

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CIRCLE INFORM-A-GRAM KEY NO. 64

. . . Month's Talk from page 60

We haven't caught up to the fact that we don't need them; we're using tractors now. If we would only analyze where we are, what we've got and try to put it on a profit and loss basis or on a supply and demand basis — I've been a great fellow in the believing of a profit motive which puts me in the classification that you can't mention in a meeting like this. But I'm a believer in the double profit system; that is, in which the customer gets a much bigger profit than the manufacturer. That's what makes the country go. Now, to get that customer profit, how much more would you pay for a telephone than you're paying now if you couldn't get another one? But I'm not even asking that, because there could be some bad influence if we do it here. How much would you pay for electric lights more than you do now if you couldn't have them replaced?

Now, those are the things that are your customer's profit, and it's always many times more than the manufacturer makes, so that the thing that has made the country grow is the customer's profit.

This brings me to another thing: that the customer runs this country, not the management, not the engineers, but I say the best and most successful companies in the world are those that run the best errands for their customers, and the engineer that is successful is the fellow that has run the best errands for his company. And in research, the ones who are the most successful are the ones that run the best errands for their projects. To me, the boss is the customer, or the problem, whatever it is, and you're not educating yourself as engineers to in any way be egotistics. You're educating yourself and this building could be the greatest servant organization in the world. Here's where you are going to learn to take a bit of information, put it in such a shape that it multiplies many times, so that the value of that piece of information in your mind and in your organization can be multiplied many times because of the service which you render.

And so this thing that you're seeing here today is the greatest public service organization in the world and I congratulate all the engineering societies in Cleveland for this magnificent effort. Thank you.

end

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(large illustration)
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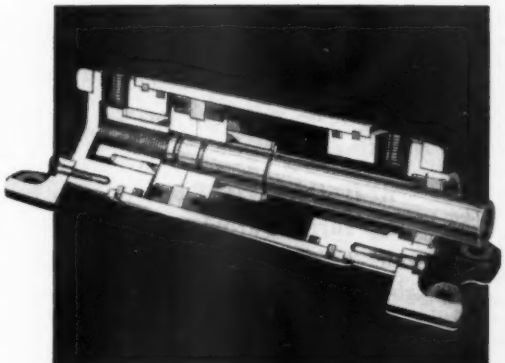
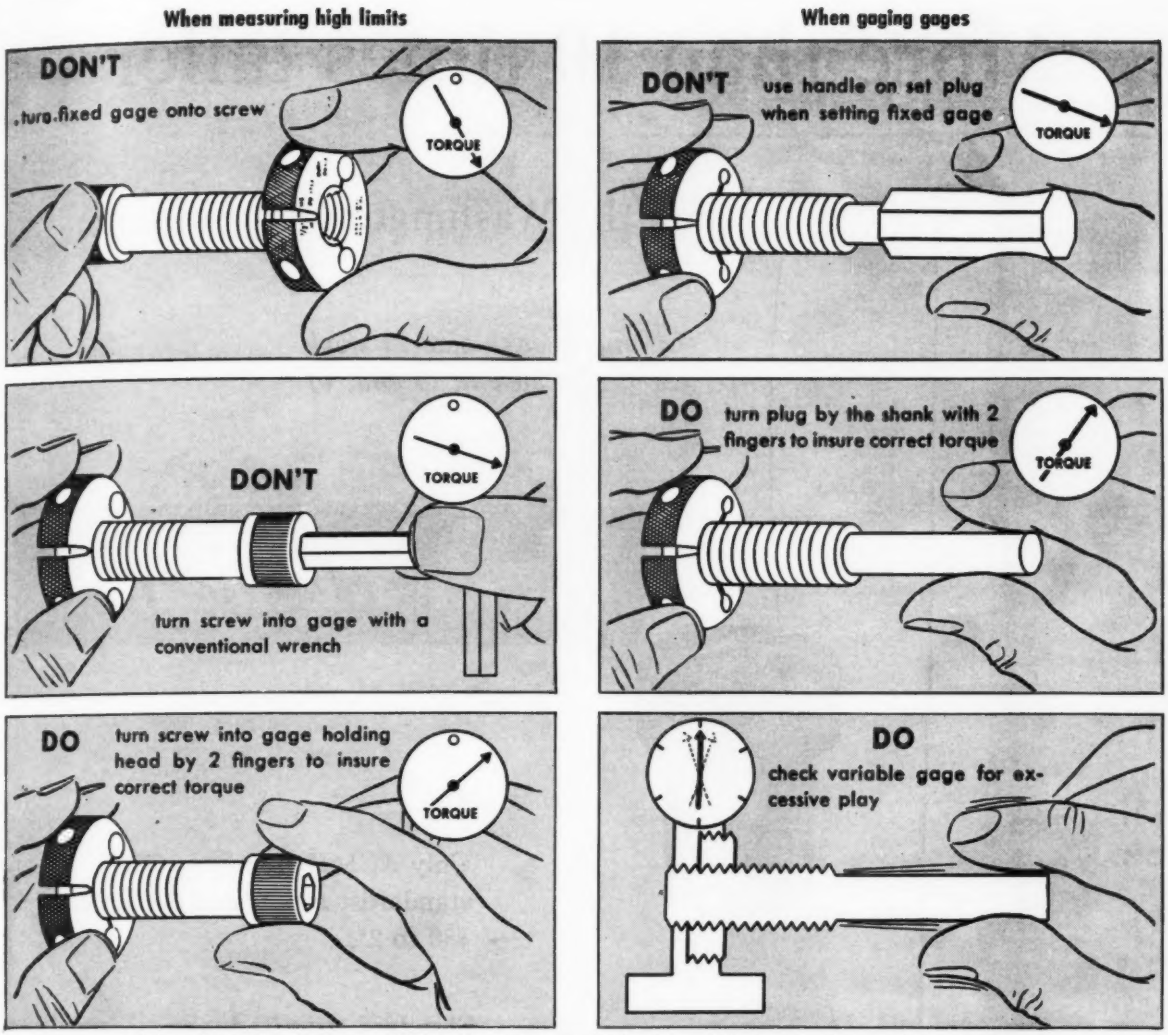


Fits Where Others Won't!



These illustrations from new SPS booklet show some of the do's and don'ts of gaging precision threads.

3A threads: what they are; how to gage them — new SPS booklet tells all

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SPS has prepared a new booklet on this subject. It explains clearly what Class 3A threads are and the pros and cons involved in the widely varying gaging techniques in use today. It reviews the gaging of high and low limits of 3A threads, sampling techniques, and even the methods of gaging gages.

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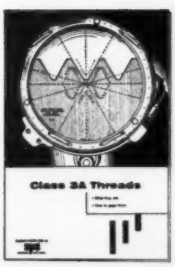

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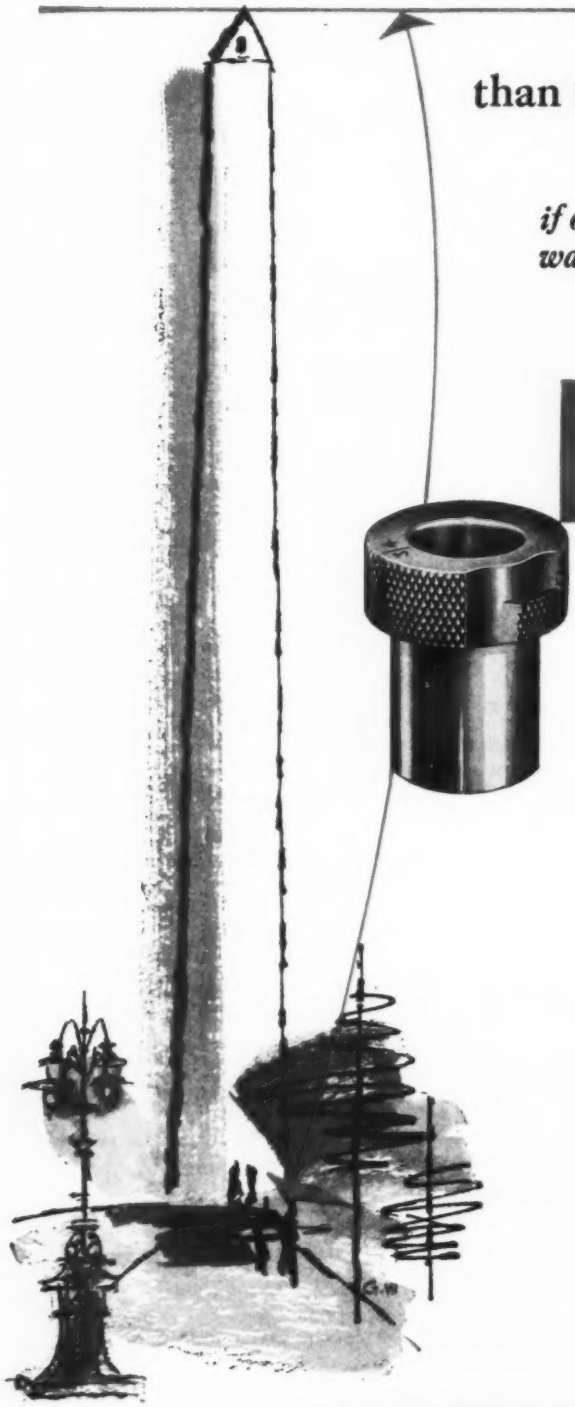

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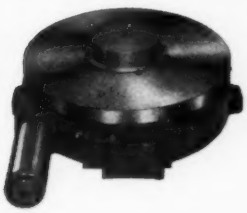

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Index Time ⅓ second
Accuracy ± .001 inch
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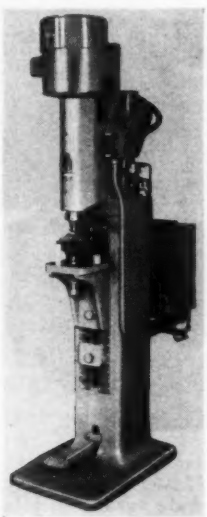

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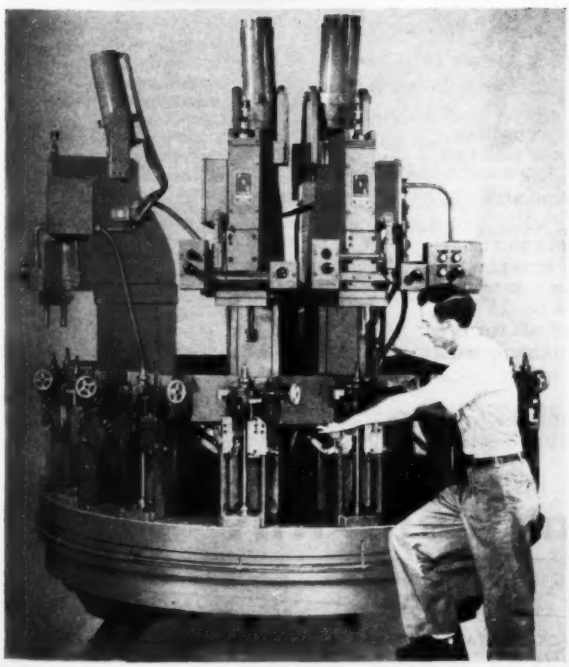

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CIRCLE INFORM-A-GRAM KEY NO. 70

Moonlighting

WALTER REUTHER'S PREGAME broadcasts have included these 1958 collective bargaining objectives: the biggest wage increase in the history of the union — a shorter workweek with increased take-home pay — and other substantial economic concessions including more for pensions, more for insurance, hospital and surgical benefits, and more supplementary unemployment pay.

As a stage setting, this is a beautifully constructed and highly resilient springboard from which the head auto worker can dive into the bargaining pool. What he will come up with will be, of course, a compromise, a meeting of the minds on both sides of the table. That will be history repeating itself.

Because of the tremendous influence that labor-management agreements in the colossal automotive industry has on other industries and on our total economy, we wish to toss out just one idea for your consideration and (if we can be so favored) your comments.

This idea is that of the shorter workweek which can only mean four days. And our concern is not so much over the idea of four working days as it is over the implications of the three non-working days.

Exclusive of Sundays, what effect would two available days per week have on the increasing practice of "moonlighting", or double employment?

Earlier this year, the Bureau of Census reported the results of a survey of workers with two or more jobs, made during the week of July 14, 1956. It found 3.7 million persons with more than one job, compared to 1.8 million moonlighters reported in a similar survey in 1950.

These figures, according to a current survey and report by The Associated Industries of Cleveland, "may be somewhat high. But in addition to the ever-pressing desire for more money, today's multiple job opportunities (particularly for skilled workers), greater mechanization, and shorter hours, it seems likely that moonlighting will be a growing problem."

As the National Industrial Conference Board points out, "Moonlighting is a fairly new term in personnel literature. It has nothing to do with making love or liquor, but nevertheless, the subject is of some general interest." And, in Scotland, according to the Cleveland report, the term moonlighting means moving from one residence to another at night to avoid paying rent!

Further, from Cleveland's Associated Industries survey, "A few years ago, the UAW was conducting a campaign to discourage the practice. At that time, it was reported to be particularly detestable to the UAW when the moonlighter's second job was in some unorganized shop. In such cases, the UAW was reported to have greater difficulty in organizing the unorganized shop because the moonlighters would vote against the unions for fear of losing their chances to work extra time in the second plant. This prompts us to point out that the UAW had better change its ideas somewhat on moonlighting, or forget about the demand for the shorter workweek."

Admittedly, in these days of higher prices for all consumer goods, moonlighting can be looked upon as a worker's way of combatting inflation. The cost to himself in health and tensions is something else. In general, moonlighting reportedly enhances tardiness, absenteeism, and degradation of work quality.

Here are several quotes from answers to the Cleveland moonlight survey:

"Signs of moonlighting are tardiness and 'goofing off' on the job (laziness). Moonlighters require more supervision. Absenteeism is not a problem because such employees are too greedy for money to be absent."

"If tardiness or absenteeism becomes excessive, moonlighters must chose between jobs. Union does nothing about it."

"Union is against holding more than one job, so evidently thinks it sufficient cause for discharge. Tardiness, absenteeism, dozing on the job and accidents are signs of moonlighting."

"Earliest sign of moonlighting is that employee's work is not up to standard."

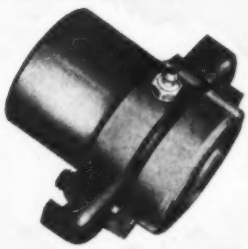
There is also the factor of increased production costs due to moonlighting. With plants having to pay time and a half for Saturday work, if Friday is added to the premium time, costs can additionally spiral, and away we go.

Moonlighting is with us to an extent that has to be considered in terms of our economy. We would value highly your opinion, pro and/or con. A few words from you on this still controversial subject would be greatly appreciated.

E. Willard Pennington

editor

LONG SHOULDER TYPE—Small toe clamp. Use to keep guide pin in bushing during stroke. Long wearing bronze plated on hardened steel, ¼" to 3" pin dia.



HEAVY DUTY—Large toe clamp, for large and heavy die sets requiring extra body and shoulder thickness. Bronze plated, 2" to 3" pin diameter.

NUT TYPE—For wide range of requirements. Available in 5 sizes, 1" to 2" pin diameter, long-wearing bronze plated on hardened steel.

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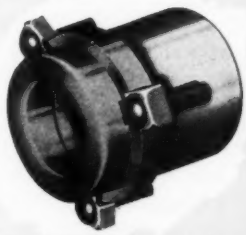
LONG SHOULDER TYPE—Large clamp. Long bearing surface contains pin during entire stroke. 2" to 3" pin diameter. Bronze on steel.



SHORT SHOULDER TYPE—For die space, more bearing area within die area. Bronze on steel or solid Ampco Bronze. 7 lengths, pin sizes ¾" to 2".

RING CLAMP TYPE—For heavy duty and bossed die sets. Bronze-plated steel or Ampco Bronze, 4 lengths, pin diameter 2½" to 4½".

TOOLING & PRODUCTION Magazine

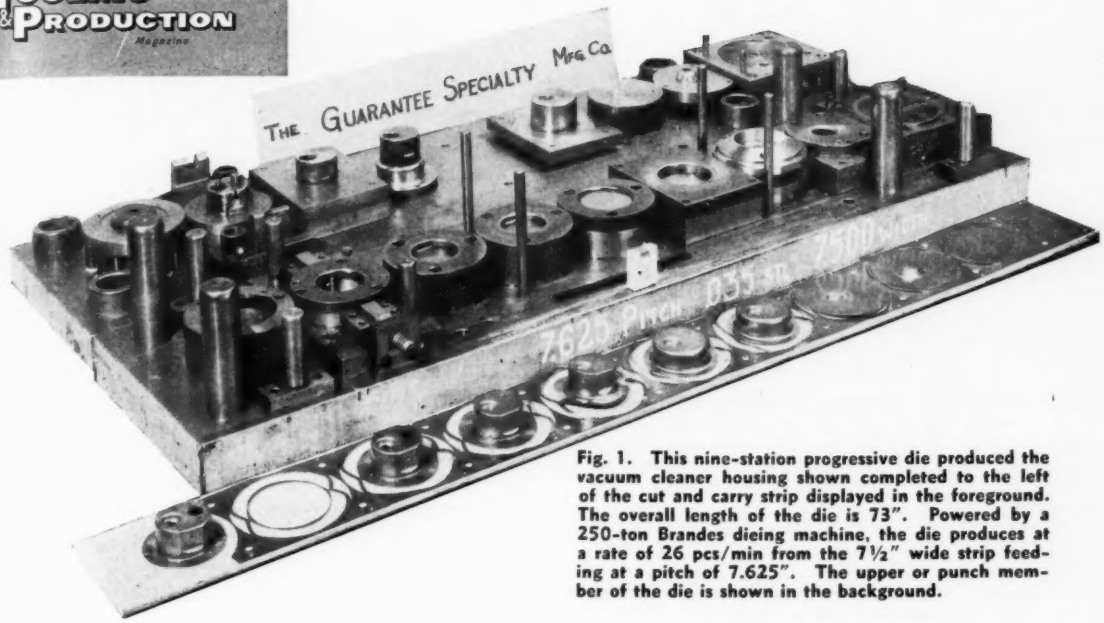


Fig. 1. This nine-station progressive die produced the vacuum cleaner housing shown completed to the left of the cut and carry strip displayed in the foreground. The overall length of the die is 73". Powered by a 250-ton Brandes dieing machine, the die produces at a rate of 26 pcs/min from the 7½" wide strip feeding at a pitch of 7.625". The upper or punch member of the die is shown in the background.

CUT AND CARRY TECHNIQUES

by Ernest J. Urbas
Superintendent, Tool and Die Dept.
THE GUARANTEE SPECIALTY MFG. CO.
Cleveland, Ohio

IN ANSWER to requests to further disclose the application of cut and carry techniques, I have selected the cut and carry die shown in Figure 1 because it is illustrative of the manner in which large stampings are made possible in jobbing lots. This die features a compound double round cutout which provides the cut blank and the carrier strips within one station of the die.

The designs to which cut and carry cuts are made are many and varied and each has its advantages and shortcomings. In this particular case, the decision as to the type of cut and carry cutout was no problem for the length of the die had to be limited, of course, to the available bed length of a 250-ton Brandes dieing machine.

The compound double round style was selected for this cut and carry cutout because there was no alternative to producing the cutout entirely within the first station of the die, Figures 2, 3 and 4. From the pitch marking on the die set (7.625"), you can appreciate its great length.

The principal advantage of the compound cutout over other types of cutouts is that the inner and outer cutouts, being cut simultaneously, are assuredly concentric with each other. Another advantage is that considerable die space is saved over methods of cutting that require two or three stations to complete the cutout.

This type of cutout has its shortcomings in that more material is required in the strip, in both width and pitch, to produce the workpiece. The explanation is that the compound punch is made with a heavy wall (6 x t) to insure its strength. Any increase in the wall OD of this tubular punch increases the width of the strip necessary to produce the piece.

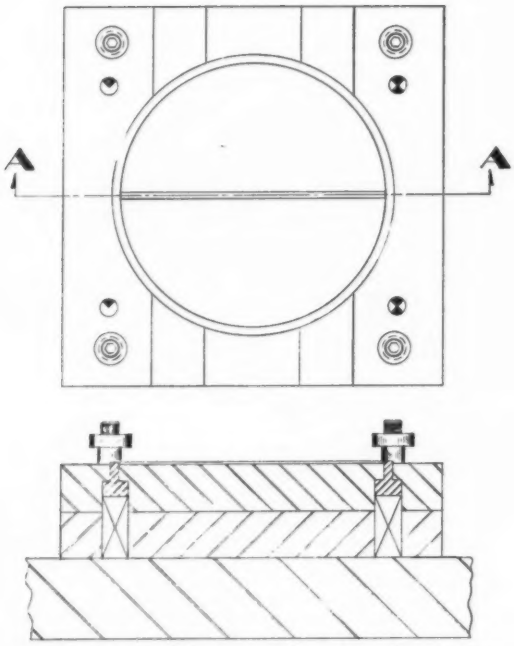


Fig. 2. Plan and front elevation of the first station. Note in upper view the double-triangle symbols denoting the pilot hole piercing punches, and, at left, the single-triangle symbols identifying the pilot pins. The lower view, section A-A, shows the capped stock guides described in the text.

And, excessive increase of the wall thickness of the cutout punch increases the stiffness and resistance of the carrier strips to moving in during the drawing operation because the wall thickness of the cutout punch determines the width of the carriers.

A thin wall (2 x t) leads to excessive breakage of the punch. The heavy wall is the lesser of the two evils. The pitch distance of the die is influenced by this wall thickness, and once the die is made there is no way to increase the wall thickness of the punch in the event the wall was too thin and caused excessive punch breakage.

This thought provoking die has many features from which you perhaps can glean an idea or two and eventually put to use. Progressive dies are not as complicated as they appear. The author advocates the building of progressive drawing dies in line with the example shown. Simplicity of die construction is attained by following a pattern of standard methods applicable to the building of any progressive stamping die which involves a cup shape. Actually, a cut and carry die is a succession of conventional dies mounted on a common bolster.

Notice, first of all, that most of the die parts are made from round rings. This affords the least machining effort because all the machining of each round die section is performed in one setup. That is, face, bore, and outside are machined in a lathe. This assures the squareness and concentricity of the bore with the face and outside.

During the initial machining of the various die sections, there is no need for machining the parts to exact over-all heights. Instead, these heights are machined to a liberal scaled dimension. It is possible, of course, to machine these parts to exact over-all heights; but, it has been my experience that this is not feasible or necessary for usually somebody "goofs" and makes at least one short height part. This means that all the other parts which were painstakingly made have to be remachined. I have found that initially machining to specified height dimensions can consume an excessive number of hours. It is so easy to grind to final and uniform heights after the die parts have all been made.

By using round rings we not only machine faster, but we also save material by using rounds instead of flats as is the general practice. Another advantage of using round rings is that a standard method of drilling the holes used to secure the rings to the shoe can be employed. This is done readily because the rings are all of the same OD. A spotting drill jig is made to fit over the top of the rings.

The spotting holes in the jig are jig bored to insure proper spacing of the bolt holes so that the rings can be bolted in any position. Making the jig may seem an unnecessary practice but let me ask "what do you do when a ring breaks during the press operation?" A standard spotting jig saves the day whenever a replacement part has to be made.

In making the die rings, it is best to make the OD of the rings the same as the pitch distance (pitch distance equals distance of feed to produce one part). It is not desirable, of course, to make the diameter of the rings the same as the pitch when the tool steel stock diameter is too large for economical usage, thus requiring excessive machining and material waste. The reason for turning the diameter of the die rings to the pitch dimension is that the die rings then can be positioned on the

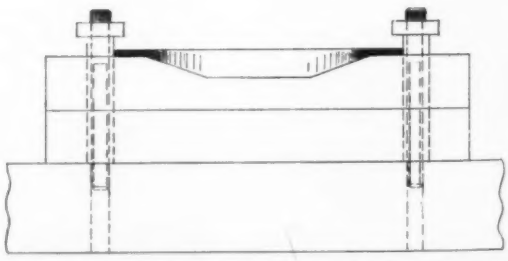


Fig. 3. Front view of station one showing the area of the die block that has been removed in order to prevent complete cutout of the outer blank.

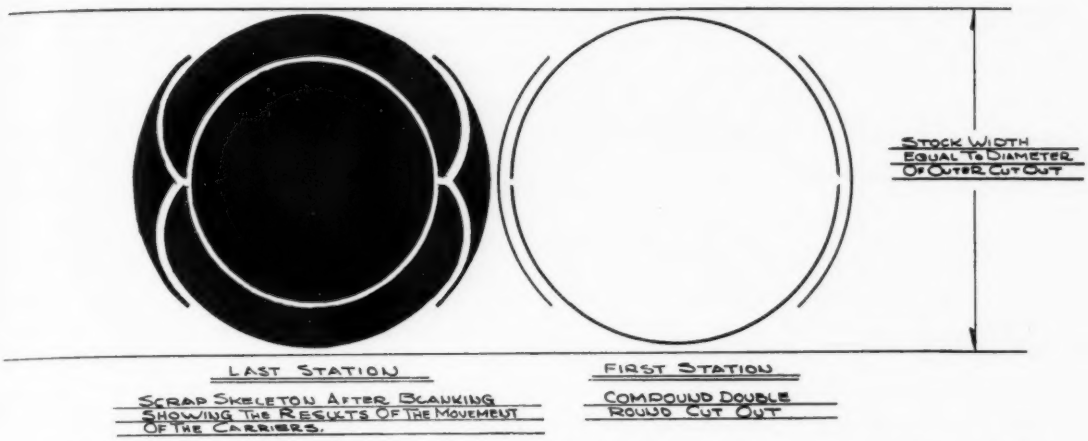

STOCK WIDTH EQUAL TO DIAMETER OF OUTER CUT OUT
LAST STATION
SCRAP SKELETON AFTER BLANKING SHOWING THE RESULTS OF THE MOVEMENT OF THE CARRIERS.
FIRST STATION
COMPOUND DOUBLE ROUND CUT OUT

Fig. 4. Schematic of operations performed at stations one (right) and nine (left). The first station produces the double round cutout essential to building this die to fit the press bed area. Note that the (projected) diameter of the outer cutout is equal to the strip width. The view of the last station (nine) shows how the carriers have moved to the point of releasing the produced part.

die shoe by simply having the die rings in contact with one another. This positions the die rings from left to right. To insure parallelism, a long bar is placed against two of the four posts and the die rings are positioned in contact with this bar, then drilled and secured, and the bar is removed.

The die rings, you will notice, are drilled and counterbored so that the screws can be installed from above. This type of mounting permits the removal of any of the die rings while the die is in the press. This is an important feature for you must realize that polishing and minor repairs occasionally occur and that the station must be removed. It is unthinkable that a die should be built so that its removal from the press would be required in order to dismantle one station. The jig drilling permits the die rings to be moved from one station to another in the event of a design change in the part. This has happened a number of times in my experience and I fully appreciate the merit of this technique both from the time saved to myself, and, even more important, the savings awarded to the customer.

Toward building a die such as we are considering, if the blank size is known and the operations have been developed one can immediately proceed. However, if these essentials are not known it would be quite a risk to proceed on the assumption that theoretically it will work. The builder of the die must wait until the draw stations have been proven and, most important, the blank size properly developed. The die rings and punches that will be used in the tryout dies will be the tools used in the automatic die.

All of this does not require too much extra time and will, in the end, result in the right decision as to the number of operations. Most important, however, the savings effected by the most economical development of the blank size will pay for this phase of the work. A cut and carry die cannot be built until the blank has been developed because the blank size determines the pitch distance. The blank size is the inner cutout of the cut and carry strip. The outer cutout becomes the carrier for the blank.

The first station of our die is the compound double round cutout. This station contains the outer blank punch, the inner blank punch, the pilot hole piercing punches, the starting pilots, and the only stock guides on the die. In order to reduce the size of the dieset, you will notice from the photograph that two of the guide posts have been moved in considerably from one end to permit the mounting of the first station because of its relative large size. If the guide posts had been placed in the standard position, a much wider dieset would have been required because of interference between the first station punch and the guide post bushings. The improper positioning of guide posts has repeatedly appeared to me as a significant oversight by many die engineers.

The four stock guides are made to slip fit in the jig-bored opening of the first station die block and are secured to the lower riser block that is beneath the hardened die block. Here again, we see the advantage of an installation which permits reworking of a component in a matter of minutes without requiring removal of the die from the press. It can happen that material is slit too wide to pass through the stock guides, hence this system of mounting stock guides is rewarding whenever it can be applied.

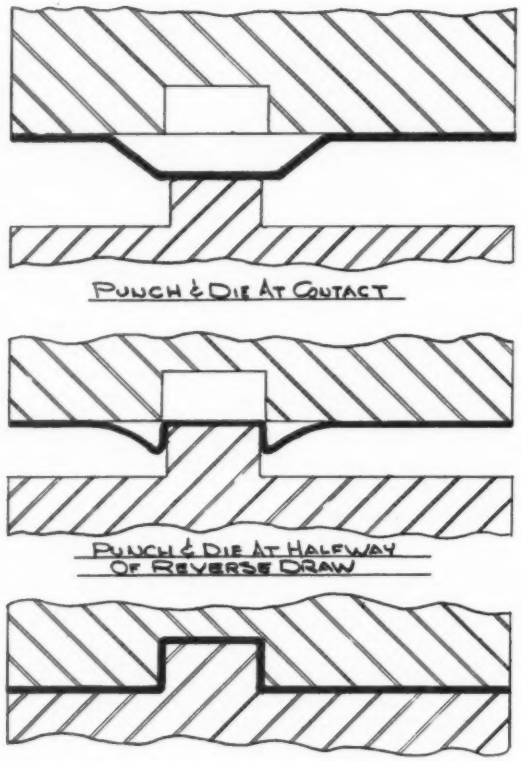


Fig. 5. Station three. Here, the dimple produced at station two is turned "inside out", as shown from contact, through half-way draw, to finish form. As explained in the text, this is a diemaking technique that conserves operations and space, and which made production of this part possible by a progressive (automatic) die within the confines of the press bed dimensions.

If the material is slit too wide, a flat spot is ground on the stock guides and the material can be used. When correct width material is again furnished, you loosen the socket screws that secure the stock guides, give them a slight turn, tighten them again and you are back in business. The stock guides serve also another purpose in that they are used to strip the material from the starting pilot punches. The caps on the ends of the stock guides perform this function. The caps also prevent the strip from leaving its path during the feeding cycle.

The second station in the die performs the drawing of the metal to produce the small drawn well. This type of drawing, taking place in a large area of metal, is an extremely difficult operation to perform. By conventional methods the drawing of this small well might require a half-dozen press operations before it would be satisfactorily produced. However, by the reverse drawing done here, this usually impossible operation was easily performed in just two stations.

This, in my opinion, is the most important feature of the die because the success or failure of the small draw during the preliminary development was the deciding factor as to whether or not the part was to be made on an automatic die.

Station three, Figure 5, is the reverse draw station in which the preformed dimple is literally pushed inside out by a punch in the lower die section.

Station four is the first draw or cupping operation. This die section is a rectangular block because its mounting holes must be beyond the material strip. Naturally, any first draw die cannot have any holes in the drawing face.

Station five is the pilot station and acts to set the pitch distance and steer the material so that it travels in a proper line in the die. Whereas the pilots in the first station are provided to start the strip, once a cup is drawn in station four the starting pilots' services are over until a new strip is started. The die of pilot station five is exactly the same size as the draw die in station four. You will observe that the large radius on the end of the drawn cup provides a generous lead for guiding the cup into the pilot opening. Inasmuch as station five is the exact pitch distance from the draw die (station four), the location of the strip as the cup is pushed into the pilot die will naturally place the carrier and blank exactly in the proper place in order to perform the first draw in station four.

Station six is the redraw station. Surrounding the punch in this station is a sleeve pilot which is under pressure. This sleeve pilot enters into the cup and applies holding pressure while the punch traveling through it reduces the part. The two flat areas on the sides of the part are also drawn during this operation. The flange of the part is somewhat distorted in this operation as is to be expected in this type of reduction draw. Therefore, station seven flattens the distorted flange and sharpens the radii of all the drawn corners.

Station eight is a three-level piercing die. It also contains two cam-operated pierce and extrude punches which punch into the two flat sides. This station is built into a small dieset to facilitate the alignment of its many delicate punches.

Station nine is the finish blank. Because of the extreme length of this die, the finished piece landed on the bed of the press when it dropped through the die. At the peak of the up stroke of the press a control valve was triggered which actuated an air cylinder beneath the die. This air cylinder literally batted the part into the press bed opening so it could fall down a chute and into a container. end

A New Appraisal of

THE FORCES IN BRAKE FORMING

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Research findings give a clearer understanding of the forming action. Prediction of forces resulting from an operation permit minimizing the breakage of dies and machines, and enable tool design to effectively design dies that will withstand the forming forces.

BY THE USE of recently-developed formulae, the maximum force in brake forming can be predicted within an accuracy of about 7% when the material, stock thickness, and die geometry are known.

Deep hat sections and channels commonly encountered in fabricating aircraft parts have long been a shop problem due to the fact that standard gooseneck dies are too thick and not deep enough for many of the required designs. These standard dies were designed for bending steel, in industries that did not have critical clearance problems. Also, since soft steel does not require large bend radii, springback was negligible. Consequently, special dies have often been required to form these deep sections in aluminum.

Early Chance Vought research resulted in the derivation of formulae and construction of various thin gooseneck dies as company standards. Use of these dies indicated that the original formulae were excessively conservative and theoretical results plotted by these formulae did not correlate well with measured forces.

Therefore, it was considered desirable to more closely evaluate the forces involved in forming materials on the press brake. A knowledge of these forces is required for the following reasons:

1. To insure the maximum force will not exceed the capacity of the brake.
2. To design the punch and die to adequately withstand these forces.
3. To better understand the forming action in order to advance forming techniques.

Information of this type is very scarce. The principal work on press brake forces was done by the Cincinnati Press Brake Company in 1911, using steel sheet samples. Additional data was prepared by the Butler Manufacturing Company and the Verson All-Steel Press Company at later dates[4].

However, the tables given by these firms refer to the tons per lineal foot for bending mild steel over a female die opening of approximately eight times the stock thickness. Obviously, this information is of little value in work consisting largely of aluminum alloys with much more restricted die space available.

General equations have been developed which give the forces required to brake form various materials on several die configurations at any angle of bending. It was found that the true stress-strain curve must be used for this type of analysis, and an approximate construction is given for obtaining the true stress-strain curve. Characteristic curves for several die shapes were established to show the effect of die shape on forces.

These formulae were checked experimentally by actual trial, indicating that the maximum force in brake forming can be predicted within an accuracy of about 7%.

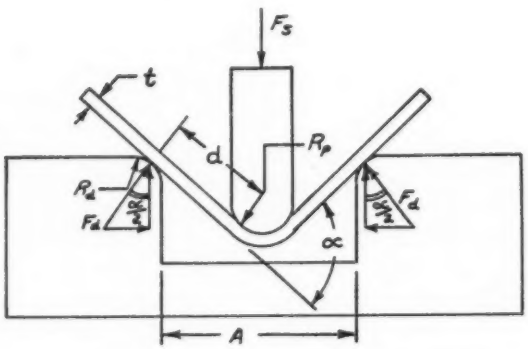
During these tests it was believed friction might be a significant factor in the total forces on the die. Therefore, a female die was constructed using rollers as the forming radii in order to minimize friction. It was found that the effect from friction at the maximum load varied up to 9% with the average being about 4%. Therefore, friction can be considered to play a very minor role in the forming forces on the press brake.

This research was concerned only with "air bends". Spring pad, solid bottoming, and other types of forming could possibly be analyzed with this theory by a superpositioning of the other relevant forces.

THEORY OF BRAKE FORMING

Geometry

In order to study the forces required in brake-forming, it is necessary, first, to describe and define the pertinent parameters associated with this type of forming. We begin with a sketch of the cross-section of a sheet of material being brake-formed:



The forces and geometry of the punch and die may be defined as shown on the sketch. F_s is the force on the punch, F_d is the normal reaction force of the die, α is the bend angle, R_p is the punch radius, R_d is the die radius, A is the die opening, t is the material thickness, and d is the moment arm shown.

It can be seen that the principal dimension is d. This can be seen to decrease as α increases at the beginning, but it may either increase or decrease, depending upon α, R_p, R_d, t, and A after a certain amount of bending. When

$$A = 2R_p + 2t$$

that is, when the die opening is just filled with the material and punch, d will diminish progressively to zero. In all other cases, d decreases at first and then increases by a sliding at the die contact point, being finally limited only by a bottoming in the die.

Forces

Neglecting friction, a force balance in the vertical direction gives[3]

$$F_s = 2F_d \cos \alpha/2$$

The bending moment on the material being formed at the tangent point of the punch is

$$M = F_d d = \frac{F_s d}{2 \cos \alpha/2}$$

The section modulus of the material is

$$I/c = \frac{wt^2}{6}$$

where w is the bend width, I is the moment of inertia, and $c = t/2$. Substituting these values into the fundamental beam equation,

$$S_e = \frac{Mc}{I} = \frac{(F_s d)\ (6)}{2 \cos \alpha/2)\ (wt^2)}\ , \text{ or}$$

$$F_s = \frac{wt^2}{3d} S_e \cos \alpha/2 \quad \text{.....I}^3$$

This is the basic equation that may be used to calculate the forming force while the material remains in the *elastic* region.

However, when the outer fibers reach the plastic region, the stress S is no longer a linear function of the strain ϵ; consequently, the above equation no longer applies. The plastic stress S_p in the outer fibers will vary with F_s in much the same manner as the true stress-strain curve. So, if S_e is replaced by S_p, we have a general equation that may be used in the plastic region,

$$F_s = \frac{wt^2}{3d} S_p \cos \alpha/2 \quad \text{.....II}$$

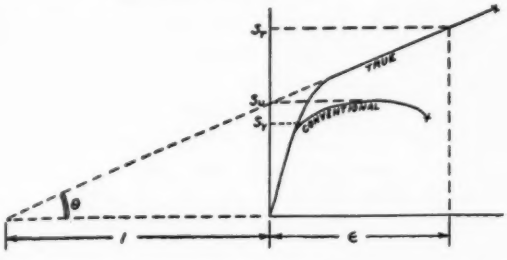
It remains now to find the relation for the stress S_p for all materials, which, incidentally, is different from the true stress of a tension test, because we are concerned with bending in brake forming.

KEY TO SYMBOLS USED

F_s	=	Force on the punch
F_d	=	Normal reaction force of the die
α	=	Bend angle
R_p	=	Punch radius
R_d	=	Die radius
A	=	Die opening
t	=	Material thickness
d	=	Moment arm
w	=	Bend width
I	=	Moment of inertia
M	=	Bending moment
ϵ	=	True strain
S_e	=	Stress-strain
S_p	=	Plastic stress
S_t	=	True stress
S_u	=	Ultimate tensile stress
S_y	=	Yield stress
K	=	Material constant
D	=	Geometric constant

The General Brake Forming Equation

It was mentioned on the preceding page that S_p would have much the same shape as the true stress-strain curve for a material. This shape may be obtained with the aid of a construction by Considere[1]:



This construction was made by starting with the definition of true stress:

$$S_t = \frac{P}{A},$$

where S_t is the true stress, P is the force in a tensile test, and A is the minimum cross-sectional area of the tensile specimen at the time the load P is taken.

By a series of derivative steps, we determine that

$$S_t = S_u (1 + \epsilon) \quad \text{III}$$

The numerical "1" in the construction represents 100% strain along the abscissa. The symbol ϵ is the true strain.

Sachs[2] shows that the strain in the outer tension fiber varies with the bend angle according to an average value as shown by the equation

$$\epsilon = .004 \ \alpha/2 \quad \text{IV}$$

This equation will determine the shape of the stress Equation III when substituted into it

$$S_t = S_u (1 + \epsilon)$$
$$= S_u (1 + .004 \ \alpha/2) \quad \text{V}$$

This equation will give the desired shape, but will have to be multiplied by a size factor K, which will depend on the material, to obtain the desired S_p in Equation II.

$$S_p = KS_t$$
$$= KS_u (1 + .004 \ \alpha/2) \quad \text{VI}$$

This equation may be substituted into Equation II to give the general brake forming force equation

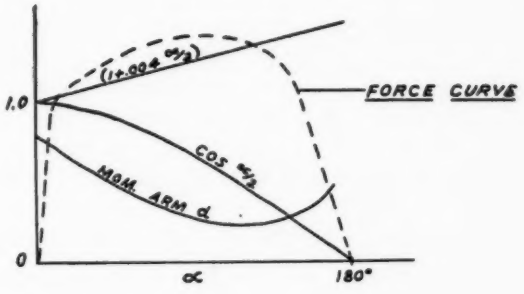
$$F_s = \frac{wt^2}{3d} KS_u (1 + .004 \ \alpha/2) \cos \alpha/2 \quad \text{VII}$$

It is now necessary to empirically evaluate K for all materials in order to be able to apply this equation. (See explanation of Equa. VIII.)

The shape of the curve for this equation may be determined by considering a given sample being formed on a given die. This would leave as variables

$$\frac{(1 + .004 \ \alpha/2) \cos \alpha/2}{d}$$

These three factors may be drawn on a sketch to show the variation of each with the bend angle α.

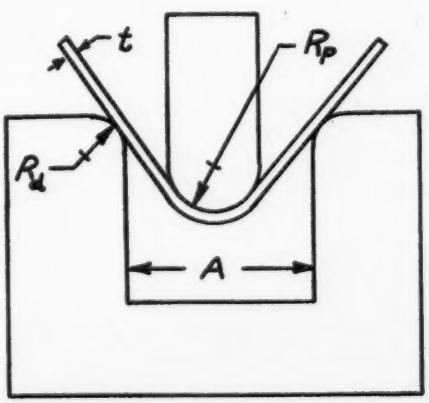


At the beginning of forming (small bend angle α), all three variables bring the curve to a high value quite rapidly. After reaching a certain value, the forces increase less rapidly because the cos $\alpha/2$ is diminishing. The force curve finally levels to a maximum value when the decrease in the cos $\alpha/2$ balances the increase in the other two factors. Then the moment arm d is increasing (being in the denominator) while the cos $\alpha/2$ is still decreasing, the result being a rapid decrease in the force curve. The theoretical curve will finally go to zero at $\alpha/2 = 180°$.

EXPERIMENTAL PROCEDURE

Five materials were selected to be used as samples for the tests with the idea of trying to maintain as wide a range of material characteristics as possible. Two steels (302-½H, 4130A), two aluminums (61S-T6, 75S-O), and one copper (Cu-½H), in gauges of .051 and .125 were used. All samples were sheared to 3″ sq.

Nine punch and die combinations were used in the tests and are shown in the sketch and table below:



Die	A	R_d	R_p	t
A_1	1.00	0.500	0.375	0.125
A_2	1.25	0.500	0.375	0.125
A_3	1.500	0.500	0.375	0.125
B_1	0.350	0.500	0.125	0.051
B_2	0.600	0.500	0.125	0.051
B_3	0.850	0.500	0.125	0.051
C_1	1.00	0.125	0.375	0.125
C_2	1.25	0.125	0.375	0.125
C_3	1.50	0.125	0.375	0.125

The punch and die on each test were mounted on the Baldwin-Southwark Tensile Test Machine. Special alignment dies were made to insure proper alignment between the punch and die. An extensiometer was attached to measure the travel. A graph of the load versus travel was recorded by the machine for each test.

One sample each of .125 gauge 4130A, 61S-T6, Cu-½H, and 75S-O was brake formed on each of the three "A" dies and a load vs. travel curve was recorded for each. Then, one sample of .051 gauge 4130A was tested on each of the three "B" dies. Finally, one sample each of .125 gauge 302-½H, 4130A, 61S-T6, and 75S-O was brake formed parallel to the grain on each of the three "C" dies. This latter test was also duplicated on dies C_2 and C_3 for the grains perpendicular to the punch axis. The 302-½H was the only material to exhibit a noticeable difference in forces to bend parallel and perpendicular to the grain.

Then, arbitrary values of force were taken from the machine-recorded graphs at intervals of 0.05" and 0.10" travel for a total travel of approximately 1" and recorded in Table I. The bend angle $\alpha/2$ and the moment arm d were both obtained graphically for each increment of travel by drawing a cross-section of the brake forming operation 10 times size. These values are shown in columns 3 and 5 in the table.

In order to evaluate the effect of friction, a roller die was made to simulate dies A_1, A_2, and A_3. Samples were made of .125 gauge 4130A, 61S-T6, Cu-½H, and 75S-O, and the resulting forces are shown in columns 15 through 18 on the table. It was found that the maximum effect from friction at the maximum load was around 9% with the average being around 4%.

CORRELATION OF THEORY AND EXPERIMENT

General Curve for Brake Forming

The general equation for brake forming (Equation VII) was found to be

$$F_s = \frac{wt^2}{3d} KS_u (1 + .004\ \alpha/2) \cos \alpha/2$$

Both sides of the equation may be made dimensionless by dividing both sides by

$$\frac{wt^2}{3d}\ KS_u$$

This gives

$$\frac{3F_s d}{wt^2 S_u K} = (1 + .004\ \alpha/2) \cos \alpha/2 \quad \text{.....VIII}$$

Plotting $(1 + .004\ \alpha/2) \cos \alpha/2$ versus α gives the (cosine) curve shown in Graph I.

TABLE 1

	Position	Travel	Angle (Degrees) $\alpha/2°$	cos $\alpha/2$	Moment Arm d	$1 + .004\ \alpha/2$	Actual Load For Solid Die F_s 4130	61S-T6	Cu-½H	75S-O	$\frac{F_s d}{S_u t^2 K}$ 4130	61S-T6	Cu-½H	75S-O	Actual Load For Roller Die F_r 4130	61S-T6	Cu-½H	75S-O
Die Number A_1 R_d = .375, t = .125 R_p = .500, A = 1.00	1	.1	6	.9945	.90	1.024		448		195		1.047		.853		433		200
	2	.2	12.5	.9753	.80	1.050		500		267		1.035		1.030		483		267
	3	.3	20	.9397	.70	1.080		552		307		.996		1.040		542		308
	4	.4	28.5	.8823	.60	1.114		627		335		1.000		.974		617		337
	5	.5	37	.8004	.50	1.148		707		382		.915		.925		683		380
	6	.6	46.5	.6894	.40	1.186		782		422		.811		.815		758		417
	7	.7	56.5	.5519	.30	1.226		883		483		.685		.704		848		467
	8	.8	67	.3867	.20	1.268		983		575		.510		.556		923		533
	9	.9	78	.2036	.105	1.312		973		662		.263		.336		883		575
	10	.1	90	0	0	1.36		783		475		.0		.0		623		475
Die Number A_2 R_d = .375, t = .125 R_p = .500, A = 1.25	1	.1	5	.9959	1.040	1.020	885	375	260	165	.911	1.01	.960	.830	865	365	265	160
	2	.2	11	.9816	.952	1.044	1010	425	290	220	.952	1.044	.978	1.012	1015	410	295	210
	3	.3	17	.9563	.871	1.068	1150	450	320	250	.990	1.084	.988	1.079	1085	435	320	240
	4	.4	23.5	.9165	.791	1.094	1230	485	345	275	.965	.994	.968	1.052	1150	465	340	260
	5	.5	30.5	.8624	.719	1.122	1255	515	360	285	.892	.957	.918	.989	1200	490	360	270
	6	.6	37.0	.7960	.653	1.148	1385	535	380	300	.895	.904	.834	.947	1235	500	370	280
	7	.7	44.5	.7143	.594	1.178	1350	535	385	300	.796	.825	.810	.862	1235	504	375	280
	8	.8	51	.6293	.553	1.204	1320	535	385	300		.765	.756	.804	1200			
	9	.9	58															

The fraction on the left side of the equation will be used to evaluate the material constant K. Since all test samples were 3" wide (w = 3"), the fraction is reduced to

$$\frac{F_s d}{S_u t^2 K}$$

All values are known except K. A value of K for each material was found empirically by plotting the value of the fraction as the ordinate for each increment of travel for each material on the cosine curve and averaging the results. In general, the final value of K was so selected that the spread of experimental values was on the conservative side as shown in Graph I.

The value of K for a material was found by graphical means to vary almost lineally with the yield stress. K becomes a constant of .675 for all materials with a yield stress of 70,000 psi or above. The values shown below are those used for the five materials studied:

Mat.	302-½H	4130A	61S-T6	CU-½H	75S-O
S_y	110	75	40	21	15
S_u	150	95	45	41	33
K	.675	.68	.55	.44	.40

The spread of the experimental points given by the fraction

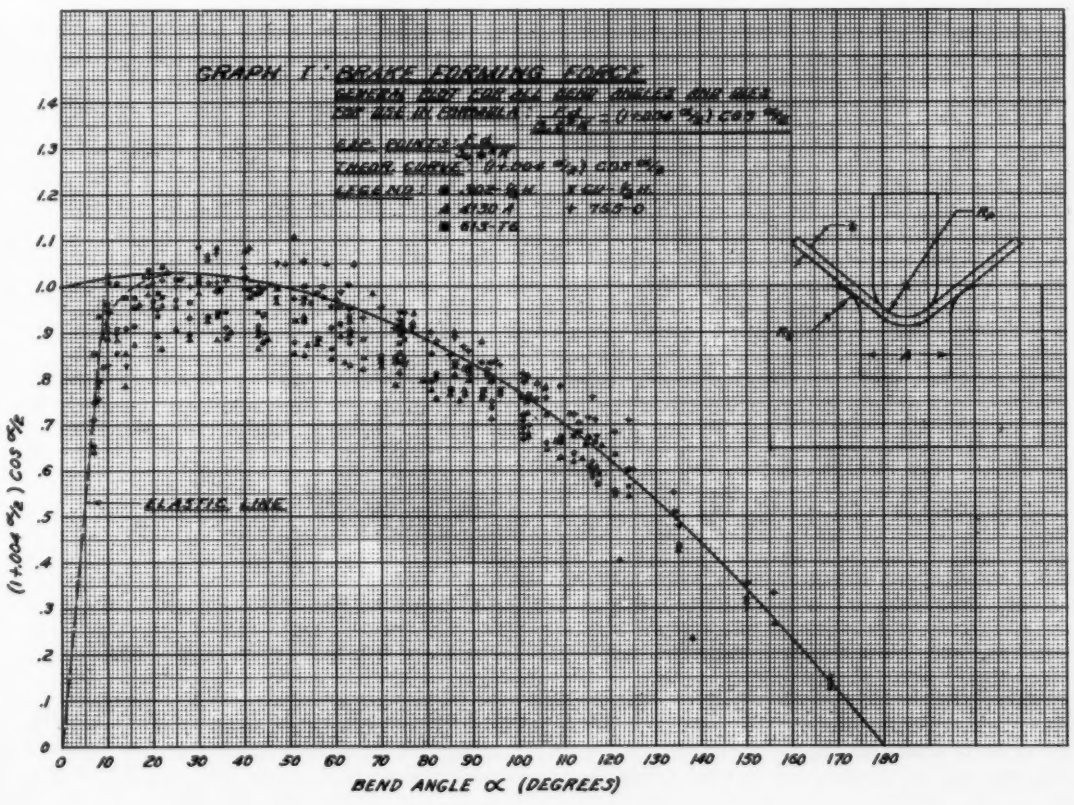
$$\frac{F_s d}{S_u t^2 K}$$

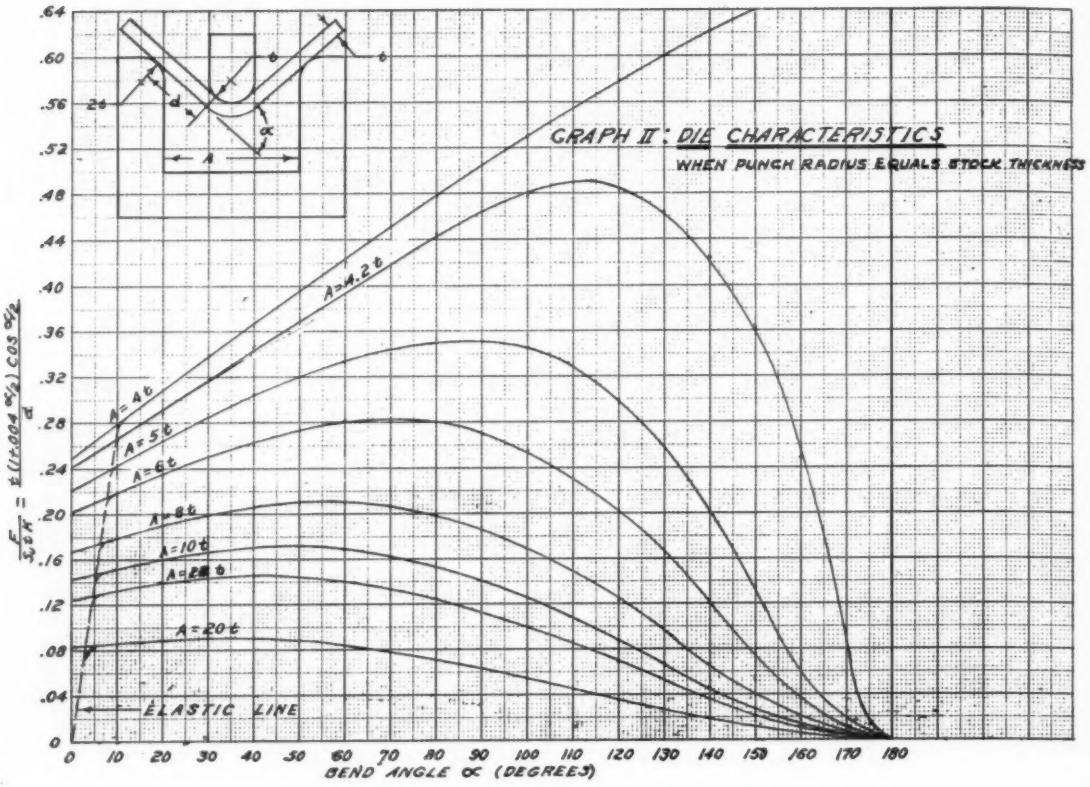
is around 12% from the theoretical cosine curve. This may be explained in several ways: (1) material variations in S_u and t, which may be as much as 10%, (2) die variations in d such as R_d, R_p, and A from the reported values, (3) spreading of the die, thus enlarging A, (4) variations in reported from actual F_s, (5) variations in friction which can be as high as 10%, and (6) coining of the die into the sample for small R_d and high F_s.

The experimental points are noted to decrease toward zero for small bend angles α. This is because the above fraction has to go to zero for $\alpha = 0$, because $F_s = 0$. This represents the elastic bending and is shown by the dotted line on the graph.

Curves for Different Dies

Several families of curves may now be computed from the general brake forming equation (Equation VII). From this equation, we have drawn a single curve which represents the forces for any die and any material at any increment of bending. Now, by manipulating certain parameters in the equation, families of curves may be drawn for different dies, each of





which is good for any material. This may be accomplished by dividing both sides of the equation used for the single curve by d and multiplying by t:

$$\frac{F_s}{S_u t K} = \frac{t\,(1 + .004 \propto /2) \cos \propto /2}{d} \quad \text{.....IX}$$

Thus, the left side of the equation is still independent of the material, but it is dependent upon the die because it has no d.

In order to draw these families of curves, all of the parameters of the die (R_d, R_p and A) are expressed in standard multiples of t as shown in Graph II, where the punch radius R_p equals stock thickness and the die radius R_d equals two stock thicknesses. On successive graphs not shown, two die radii (R_d = 2t, 4t), four punch radii (R_p = t, 2t, 3t, 4t), and several multiples of t for the die opening A were selected as standard.

It is significant to note that the special dies whose openings are completely filled with the material and punch, that is A = 2(R_p + t), the force curves are shown to increase to a maximum value and simultaneously go to zero as the bend angle $\propto$ reaches 180°. This occurs because both cos $\propto$/2 and d go to zero at $\propto$ = 180°. However, just before this happens, d is decreasing much faster than is cos $\propto$/2, thus causing the curve to reach a maximum as $\propto$ approaches 180°. Such a curve is the uppermost one on Graph II.

As the die opening A is increased from this minimum value, the curve for the forces decrease as shown. The die opening is especially sensitive for small enlargements from the minimum spacing. This is shown by the large drop from the top to the second curve. Enlarging the opening by only .2t above the minimum decreases the maximum force by as much as 25%.

The maximum point on each curve is the primary point of interest and will be the subject for the next section.

It should be noted in using Equation IX or the various curves, the result is the force per lineal inch of bend width (or length).

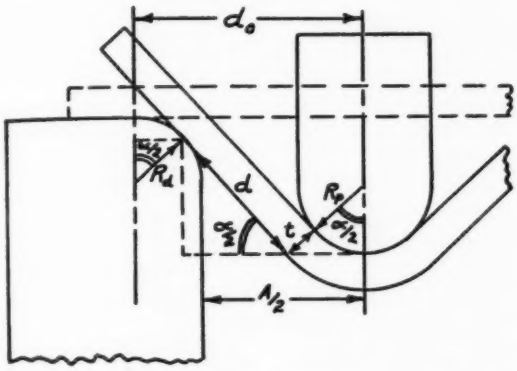
The Maximum Force for Any Die and Any Material

The Maximum force developed during brake forming may now be found mathematically for any material and any die, knowing only the material gauge t and the die constants R_p, R_d, and A.

The maximum point on each curve of Graph II can be found by setting the derivative of the ordinate equal to zero.

$$H = \frac{F_s}{S_u t K}$$
$$= \frac{t(1 + .004\ \alpha/2)\ \cos\ \alpha/2}{d}$$

Before we can differentiate, however, we must find the relation of d in terms of α. This may be found by observing the geometry of the cross-section during brake forming:



The original moment arm before forming may be denoted as d_o and is equal to

$d_o = A/2 + R_d$

$= R_d \sin \alpha/2 + d \cos \alpha/2 + (R_p + t) \sin \alpha/2$. Now, solving for d, the result is

$$d = \frac{A/2 + R_d - (R_d + R_p + t) \sin \alpha/2}{\cos \alpha/2} \quad \text{.....X}$$

The relation for H will now be found

$$H = \frac{t(1 + .004\ \alpha/2) \cos \alpha}{d}$$
$$= \frac{t(1 + .004\ \alpha/2) \cos^2 \alpha/2}{A/2 + R_d - (R_d + R_p + t) \sin \alpha/2}$$

This is the ordinate of the curves in Graph II. Differentiating this ordinate with respect to the abscissa α and setting equal to zero will give the angle for which the maximum force is developed on a die.

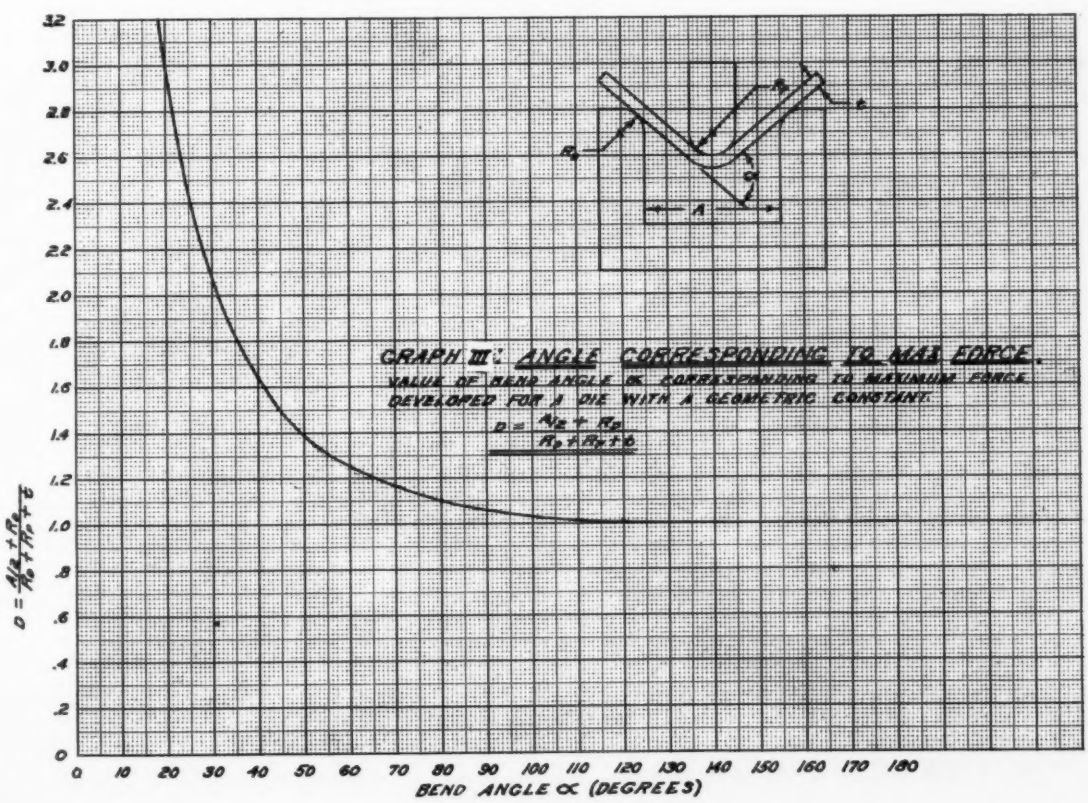
$$\frac{dH}{d\alpha} = 0$$

$$D = \frac{A/2 + R_d}{R_d + R_p + t}$$

$$\frac{(1 + .004\alpha/2)\ (-\frac{1}{2} \cos^2 \alpha/2 - \sin^2 \alpha/2) + .002 \sin \alpha/2 \cos /2}{(1 + .004\alpha/2)\sin \alpha/2}$$

$$.002 \cos \alpha/ - \cos \alpha/2$$

It is too difficult to determine the angle α mathematically, but by plotting the right side of the equation against α, we get a fairly simple curve as shown in Graph III. This graph will give the bend angle α corresponding to the maximum force (F_s) developed for a die with a geometric constant



$$D = \frac{A/2 + R_d}{R_d + R_p + t} \quad \text{XI}$$

Thus, the procedure for determining the maximum force developed on a die would be first to calculate D for the die and material. Then, by using this value on Graph III, a corresponding bend angle α can be found. Substituting this value of α, the value of the moment arm d as given by Equation X, and the other parameters of the part into Equation VII, the maximum force can be found.

As an example, we may calculate the maximum forces developed on die A_3 for the four materials used. D may be calculated to be

$$D = \frac{A/2 + R_d}{R_d + R_p + t} = \frac{.750 + .500}{.500 + .375 + .125} = 1.25$$

Graph III shows the corresponding angle to be $\alpha = 60°$ and $\alpha/2 = 30°$. Now, d may be found by using Equation X

$$d = \frac{A/2 + R_d - (R_d + R_p + t)\sin \alpha/2}{\cos \alpha/2}$$

$$= \frac{.75 + .50 - (.50 + .375 + .125)\sin 30°}{\cos 30°} = .866$$

The maximum force developed can be calculated from Equation VII,

$$F_s = \frac{wt^2}{3d} KS_u (1 + .004\,\alpha/2)\cos \alpha/2$$

Substituting the width of the bend and other values into the equation,

$$F_s = \frac{3(.125)^2}{3(.866)} KS_u (1 + .12)(.866) = .01745\, KS_u$$

Substituting the value of K from the graph for this parameter and S_u (see text following Equation VIII), we get

Material	Calculated Max. Force	Experimental Max. Force	% Error
4130A	1125	1080	4.4
61S-T6	431	425	1.4
Cu-½H	315	307	2.5
75S-O	230	245	6.5

The calculated maximum force was found to agree very well with experiment.

CONCLUSIONS AND RECOMMENDATIONS

Several conclusions may be drawn by comparing the force curves for the 52 standard die sets employed. For instance, it is immediately obvious that increasing the die spacing A while holding die radius R_d, punch radius R_p, and stock thickness t constant will decrease the forming forces. It should also be noticed that, by increasing punch radius R_p from 1t to 4t while holding die radius R_d, A, and stock thickness t constant, the force curves diminish progressively.

It is less obvious, however, that the forming forces should decrease as die radius R_d is increased from 2t to 4t while holding punch radius R_p, die spacing A, and stock thickness t constant. In each case, the die with the larger die radius R_d requires the smaller force.

It is significant to note that for the special dies where the punch and material just fill the die opening, $A = 2R_p + 2t$, the maximum force is developed at the end of the stroke ($\alpha = 180°$). In all of the other dies, the maximum force is reached when sliding begins between the die and the part. The angle at which this maximum force occurs decreases as the die opening A is enlarged.

Curves such as shown in Graph II may be used in design. Similar curves may be drawn for any die by following the same method. In general, it is recommended that the die spacing A and the die radius R_d be as large as possible so as to minimize the forming forces. This will also lessen the possibilities of marking the part.

end

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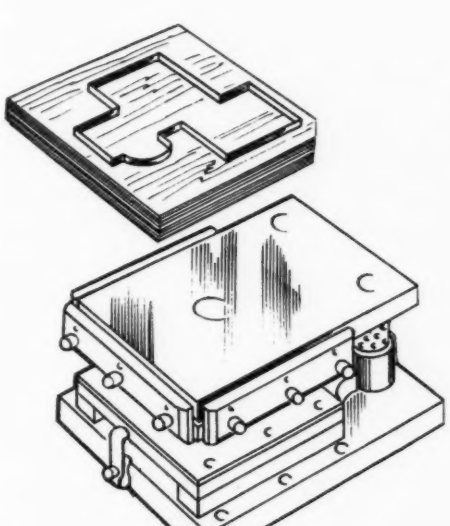
Die Set for STEEL RULE Dies

Boost Precision and Economy



Sketch of the new die set for steel rule dies, ready for use. At the top of the sketch is a steel rule die.

WHEN DEVELOPMENT ENGINEERS at Lempco Industrial, Inc., first became acquainted with steel rule dies they, like numerous other engineers, were amazed at the simplicity of the process and the work it could accomplish. Thin hardened steel rules, set into plywood by non-toolmakers, were producing thousands of blanked parts from metals, plastics, leathers, and other materials.

The steel rule dies were contained in conventional die sets. These usually offered satisfactory results, but hardly as precise, trouble-free, and economical as they could be with a die set specifically designed for the steel rule dies. Those who had been experimenting with steel rule dies recommended that extreme care be used in aligning the press. Some even recommended that guide pins be used for all but extremely thin materials.

Lempco Industrial's new steel rule die sets were developed with these points in mind. The six sizes — from 9″ x 6″ to 48″ x 36″ — operate on a full set of ball bearing guide pins and bushings. Their design and construction assure an accuracy and precision never before attained with steel rule dies, and offer insurance against cracked and damaged dies, ruined parts, and other causes of downtime. The ball bearing pins and bushings provide a "press fit" on the guide pins, yet are friction-free and need lubrication only occasionally.

Location references and die set sizes are standardized to provide for maximum and quick interchangeability. For example, change the plywood-based steel rule die, the adapter plate, and filler blocks, if necessary, and different operations can be handled in the set. Many of the flat steel rule dies can be stored in the space formerly reserved for a few conventional blanking dies. They properly mount dies for processing all materials, such as high heat stainless, titanium, S-T aluminums, 1010-1095 steels, chromium, magnesium, paper, etc.

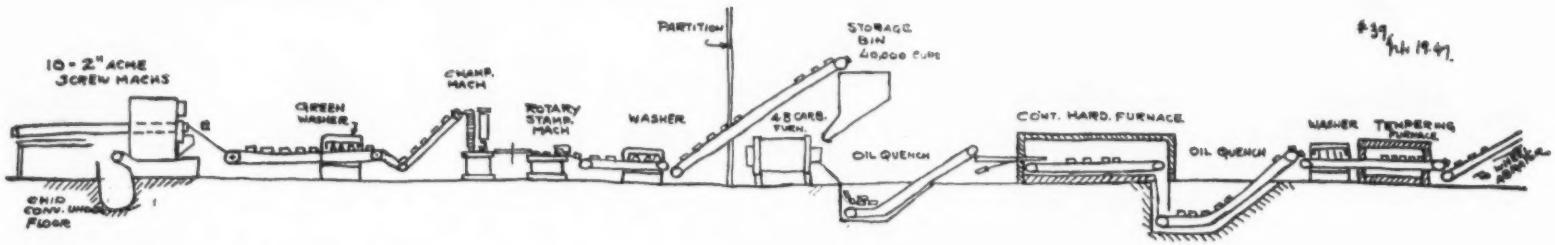
A. O. Smith Corporation reports that they are making steel rule dies for blanking operations in $\frac{1}{10}$ the time and at $\frac{1}{10}$ the cost of permanent tools. A large appliance manufacturer estimates an 80% savings with the use of steel rule dies, in addition to the large savings they have realized recently through the use of modernized automated production lines.

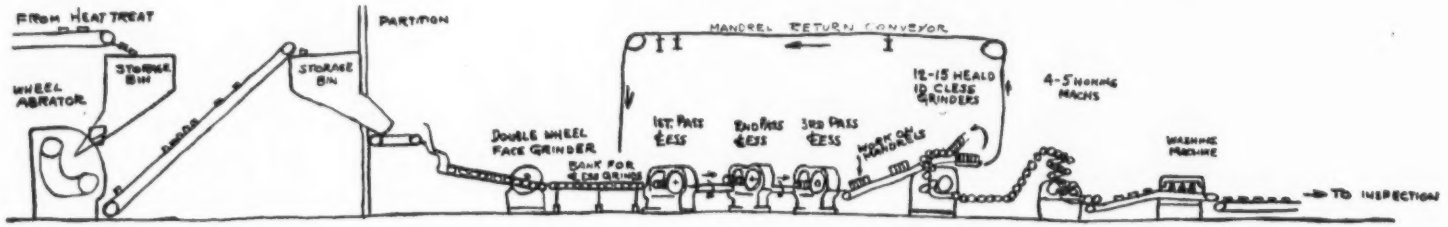
Lempco President James J. Strnad earnestly believes that the nominal cost of steel rule dies is reason enough for their increasing use in the near future. Increased use of steel rule dies, of course, means an increase in the manufacture and sale of steel rule die sets, and he estimates the potential of the business for Lempco appears so great that their Industrial Products affiliate's sales will double in another year.

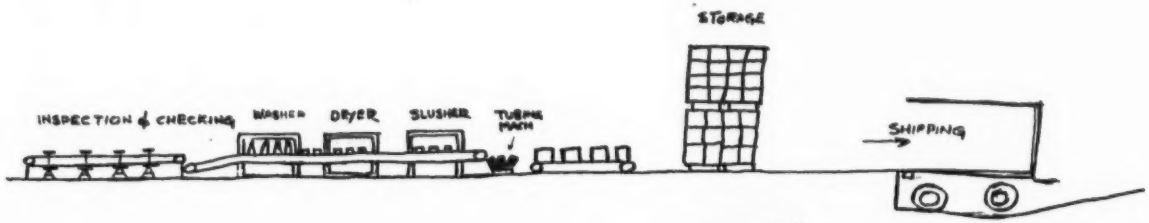
Besides blanking, steel rule dies offer potential savings when used as trimming dies for die castings and stampings, and when used for comparatively shallow forming operations. Lempco Industrial's Sales Manager R. P. McIntyre even forsees the use of progressive steel rule dies, doing three or four operations with each stroke of the press, and at a lower cost than would be possible with conventional dies.

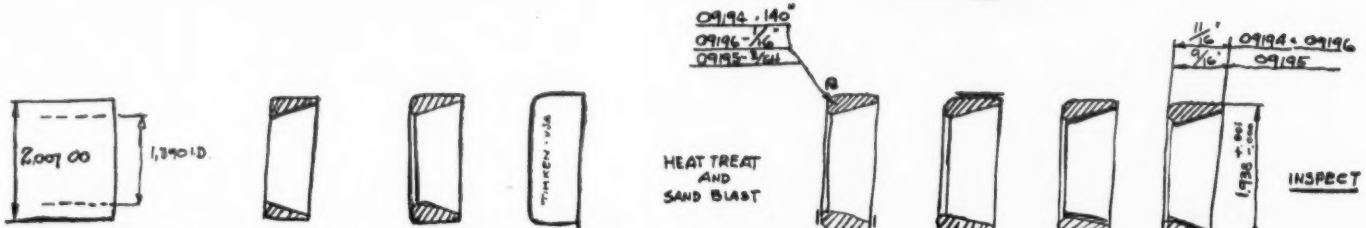
Although the methods for making steel rule dies are amazingly simple, and the time and money-saving advantages are outstanding, companies cannot jump onto the steel rule die wagon without consulting with the patent holders and licensers, Template Industries, Inc.

end









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#39 FEBR M-47
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BEFORE AND AFTER

THE DRAWING on the facing page is not a Rube Goldberg device. Far more practical, it is a choice and true example of Automation Americana. It is a reproduction of an original sketch made in February of 1947 by A. L. Bergstrom, Vice President of the Timken Roller Bearing Company.

It is his initial concept automation-wise, process-wise, and flow-wise of Timken's wondrously automated bearing plant in Bucyrus, Ohio.

The plant pictured above is what grew from his original concept through the planning and skills not only of Timken engineers, but the planning and skills of the machine tool builders and their engineers who shared in the fruition of Mr. Bergstrom's dream-come-true.

Although next month we will give you, after visiting the Timken plant, a play-by-play account of a piece of steel tubing's travels from the receiving dock to the inside of a carton of finished bearings, we are pleased to pass along, herewith, the Timken Company's very generous recognition of the contributions made by these outside "helpers."

They are: F. H. Chapin, C. W. Simpson, A. E. Drissner, President, Executive Vice President and Vice President in Charge of Engineering and their associates at the National Acme Company; Herbert H. Pease, President of the New Britain Machine Company and his associates; M. A. Hollengreen of the Gardner Machine Company and his associates; F. V. Geier, President of the Cincinnati Milling Machine Company and his associates; Roger N. Heald, President of the Heald Machine Company and his associates; E. G. de Corioles of The Surface Combustion Corporation and his associates; C. B. Moore, President of the Moore Products Company and his associates; A. J. Kraus, President of the Kraus Design Incorporated and his associates; P. J. Foley, Vice President of the George T. Schmidt Company and his associates; and John Herkenhoff, President of the Minster Machine Company and his associates.

end

A Unit of Simple Design Facilitates Weldment Layout and Erection

by H. Koslow
Bronx, New York

IN THE COURSE of our plant activity we do a variety of machine building work that frequently presents the problem of fabricating a large weldment. This necessitates measuring and squaring up widely spaced components and ordinarily requires special equipment. Large cast iron floor plates, large measuring tools, and equipment for squaring by optical methods are found in large shops where a large volume of this type of work is performed.

Our volume of such work does not warrant the investment in the expensive equipment usually used. Consequently, we have designed and built a simple unit that enables us to do a good job of layout and erection of weldments.

Basically this device provides a vertical reference line, which in turn permits the determination of horizontal lines and planes in space.

Figure 1 shows an assembly view of the device in use. Figure 2 shows the construction of the upper and lower ends. The vertical member is a steel tube with a plug in the lower end. This plug is machined to provide a conical seat that rides on a stationary steel ball.

The ball is welded to a threaded plug that screws into a socket set flush with the floor and bottoms against a shoulder.

A second ball is welded to a plug that makes a sliding fit in the upper end of the tube, and is spring loaded as shown. The lower end of the spring bears on a fixed plug. A pin set in a

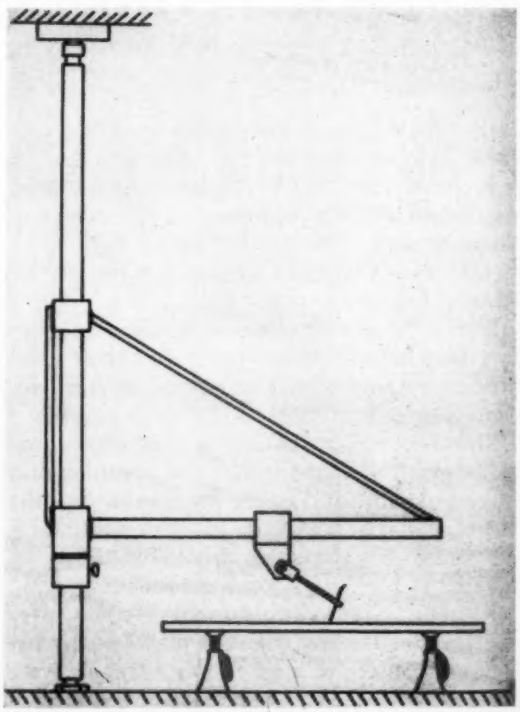


Fig. 1. Assembly view of a simple unit for layout and erection work on weldments.

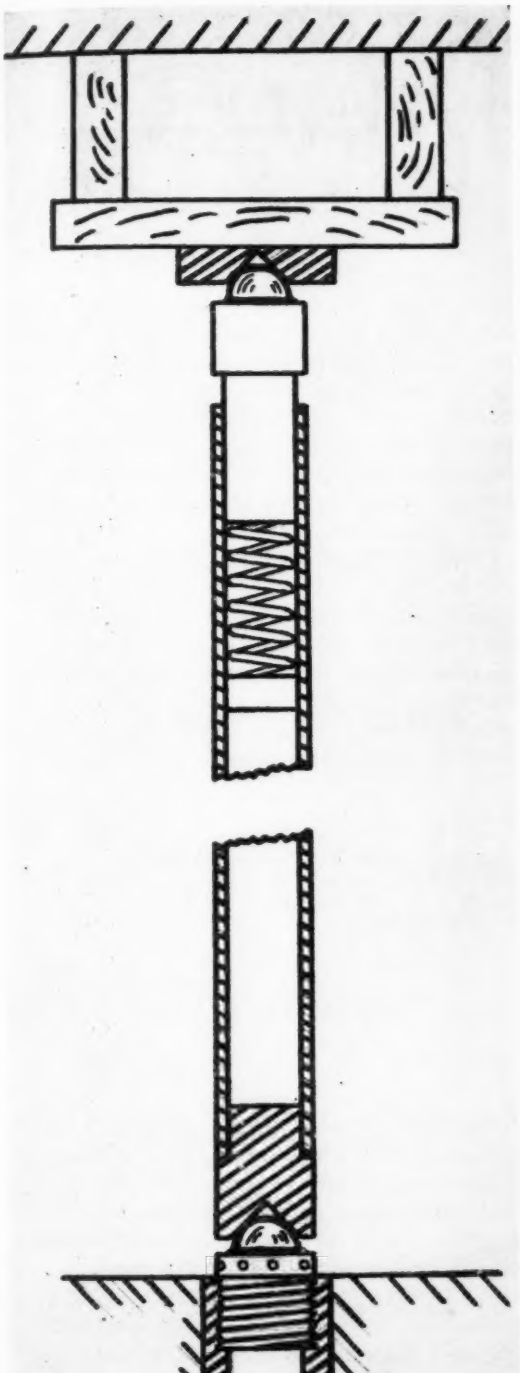


Fig. 2. Cross section view of the upper and lower ends of this layout unit.

slot (not shown) prevents the spring from forcing the plug out of the tube.

This spring is quite stiff so as to keep the ball securely seated in a conical socket bored in a plate that is mounted on the ceiling.

Riding on the tube are two sleeves as shown in Figure 1. These serve as the mounting for a triangular frame, which is rotatable about the tube. A third sleeve is arranged to clamp in place on the tube and thereby hold the frame at a determined level.

The lower leg of the triangle is square with the main tube. It is made of rectangular bar stock and carries a rider as shown. This rider in turn carries a trammel point.

The device is shown in Figure 1 being used to set up a plate on screw jacks. This is a very simple operation and ordinarily would be done with a level, but it illustrates the application of the unit. The movable collar is clamped on the tube at a suitable height thus locating the rotating triangle frame. The trammel is used to check the position of the plate by swinging across the plate and in and out along the horizontal beam.

As additional components are added to this plate the trammel is used to position them parallel with the plate. The device is much like a giant surface gage, but the rider slides on the beam instead of the base sliding on a surface plate.

If this device is made with sufficient care, a dial indicator can be substituted for the trammel to insure more accurate work. Also an inverted height gage can be clamped to the rider and used for laying out holes on the sides of a weldment or casting.

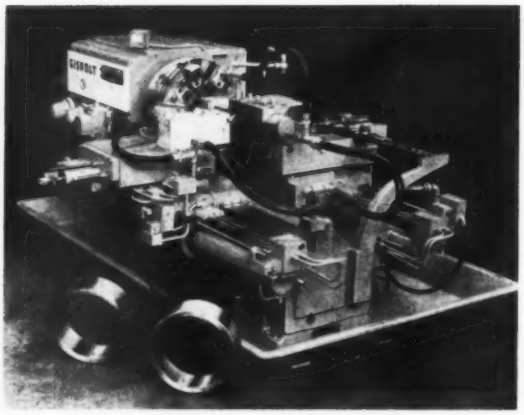
It is important that the tube proper be straight and that the radial arm be straight and square with the tube. The ceiling socket should be constructed so that it can be shifted until the tube is vertical. This will permit levels and plumb lines to be used in conjunction with the device. Experience has shown that this unit, although roughly made, is very useful and will assist in speeding up layout and erection work.

When a job is finished the tube can be easily removed and placed in a storage area for future use. To accomplish this, the lower ball is unscrewed from the floor and the socket capped. Use of the ball mountings makes it unnecessary to square up the mountings themselves; it is only necessary to have the ceiling mounting directly above the lower mounting.

There are times when a large weldment has to be assembled around the tube. This can be done and then removing the tube permits completion of the welding operation.

Where the ceiling is very high or an overhead crane interferes with the installation, the tube can be set in a deep socket and the upper mounting dispensed with. end

Hydraulic Tracer Unit Ups Bearing Race Production



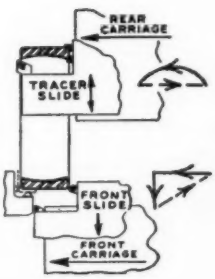
A general view of the No. 24 lathe with two finished pieces on the floor.

DESIGNED FOR QUICK SETUP, heavy stock removal on roughing cuts, and low tolerance on finish cuts, a new hydraulic tracing unit has been developed for use on either automatic or turret lathe operations.

One application of this Gisholt hydraulic JETracer unit, built by Gisholt Machine Company, is the machining of inner and outer bearing races on a single spindle heavy duty No. 24 automatic production lathe. It is tooled to handle 6 different types and 24 different sizes of races.

The 52100 bearing steel outer race forging shown in one of the illustrations has an 18″ OD and is 5¾″ wide. Two operations of 8-min duration are required to complete each part with 90 lbs of metal removed. For the first operation, standard front slide tools turn the OD up to the chuck jaws and face while the JETracer controlled rear independent slide tools rough-generate the spherical bore and break the OD and the ID edges at the end of the cut. The roughing cut is ¾″ on a side at 0.022″ feed at 250 fpm.

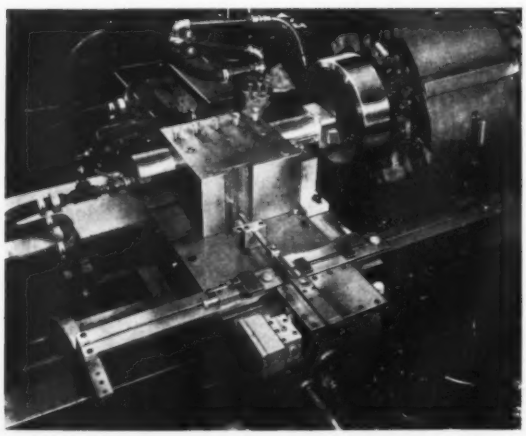
Chuck jaws are changed for the second operation, the piece turned end for end, the template relocated and the stops adjusted. Standard front slide tools finish turn the OD and face the other end while the tracer controlled rear independent slide tools finish generate the spherical bore, holding a 0.0005″ tolerance, and break the OD and ID edges to finish the part.



Sketch showing direction of movement of front and rear carriages and slides.

The JETracer operates at high pressure with slide movements controlled by a stylus type follower and template arrangement. Square faces can be machined and a single tool can also generate up to 30° included angle. It is a rugged, stable unit which easily permits cuts of ¾″ depths at 0.035″ feed. Setup is quick with convenient micrometer adjustment screws provided for accurate slide and template positioning.

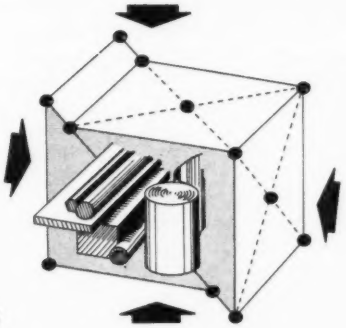
The preceding is one of the applications taken from a collection published in Gisholt's Form No. 1171-ATP. end



A rear view of a No. 24 automatic production lathe showing the JETracer unit mounted on the rear slide. The convenient micrometer adjustment screws provided for accurate slide and template positioning may be seen on the template carrier mounted over and at the rear end of the slide. The template in position on the carrier is for the first spherical boring operation.

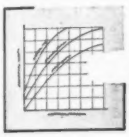
A TOOLING & PRODUCTION SPECIAL REPORT:

COLD FORMING



Have you considered it inplanning for tomorrow?

by William E. Hoffman
Associate Editor
assisted by
G. MacF. Tuttle
Assistant Editor



METALLURGY 93

COLD EXTRUSION . . 95

IMPACT EXTRUSION 97

COLD FORGING . . . 101

COLD HEADING . . . 102

DEEP DRAWING . . 105

SWAGING 107

THREAD ROLLING . 109

BURNISHING 112
ROLLER BURNISHING 114
BEARINGIZING 114
BALLIZING 116
BALL-BROACHING 116
TURKS HEAD 116
ROLLED EXTRUSION 118
SPINNING 118
TUBE BENDING 120
ROLL-PLANISHING 120
ROLL-FORMING 120
STRETCH-WRAP FORMING 122
SHOT PEENING 122
FORM & SPLINE ROLLING 122

Introducing the Art and Science of Making "No Chips" . . .

THE VARIOUS PROCESSES for working metal cold run the gamut of past and present fabrication possibilities, and few competitors for today's market (and tomorrow's) can afford to overlook "a better way to do it". Much of the emphasis in recent years has been on the production of high strength materials upon which aircraft engineering could be based. It is not necessary, however, that the reader be involved in the manufacture of components for missiles or high speed aircraft to be used within the "thermal thicket" for him to benefit from cold forming information.

The developments and processes covered here just didn't happen overnight; old timers, independents, and enterprising groups have been endeavoring to keep pace with metallurgical demands and advances and have come up with some startling developments. Some interesting ones are not as yet being discussed freely, but watch for them, as they will fast become conventional practice. Since most of the new abilities of which we speak are concerned with the forming of cold metals, we thought some generalities on each of the conventional cold forming processes would be in order. For that reason, this important subject has been explored and brought up to date in terms of the latest practices.

This major upheaval — the switch from hot metal working to cold metal working where applicable — has many advantages and owes much of its success to equipment suppliers who venture ever farther from the conventional machines of yesterday and today. Their willingness to try the untried, their ingenuity, and their pioneering of large and costly machines served to overpower metals' resistance to fall in line.

For all practical purposes, metals can be likened unto liquids as they tend to be incompressible. A compressive force to create a smaller volume in one area will result in an increased volume in other areas. There are many methods of working a metal by flowing it; these overlap decidedly as to how they are accomplished. We feel that the determinant, as to what to label the method, would best be established by what takes place within the metal rather than the cause and effect.

Webster says to forge is to hammer. There can be little argument with saying that one blow (as in some heading) is a hammer blow. Further, it need not be a series of blows (as in hot forging) for it to be said that a material was forged. Also, "swaging" is said to be forming metal by hammering. So we have another overlap of nomenclatures that may or may not be confusing. This brief discussion is only to point out that a process may very well be called by various names and leave entirely different impressions with as many people. By the same token "extrusions" are often called "forgings." But unlike forging by heading, an extrusion has usually been forged in some of its sections and extruded in others. In truth, three basic types of metal working are employed, i.e., impact extrusion, extrusion, and forging.

"Cold working" has been defined as any plastic deformation of metal which increases its strength and hardness. When deformation is cold, we no longer have the problem of oxidation that causes finish problems to be dealt with in extra operations. Then too, greater dimensional accuracy is possible.

Several of the more obvious advantages of deformation or fabrication by these methods are: 1) making parts economically by saving material; 2) making parts quickly, often with only one motion thus permitting a saving in labor and achieving better delivery; 3) providing fewer operations which often means less expense for equipment layout; 4) making some parts which can't be made in any other way.

There are government agencies for the conservation of about everything

ACKNOWLEDGMENTS

WE TAKE THIS OPPORTUNITY to thank the following manufacturers who provided our editorial staff with an extensive background of authoritative information for this cold forming feature.

Their assistance, whether written or by personal interview, typifies the spirit of friendly cooperation that prevails when a project of this nature calls upon the metalworking industry.

Airline Welding & Engineering Company
Allegheny Ludlum Steel Corporation
Aluminum Company of America
Aluminum Limited
American Roller Die
Cyril Bath Company
Battelle Memorial Institute
Besley-Welles Corporation
E. W. Bliss Company
Boeing Airplane Company
Camcar Screw & Manufacturing Company
Carpenter Steel Company
Chambersburg Engineering Company
Chase Brass & Copper Company, Incorporated
Cincinnati Milling Machine Company
Cleveland Cap Screw Company
Cliff Manufacturing Company
Cogsdill Tool Products, Inc.
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Drop-Forging Association
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Prutton Corporation
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Reed Rolled Thread Die Company
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Sheffield Corporation
Steinle Machine Company
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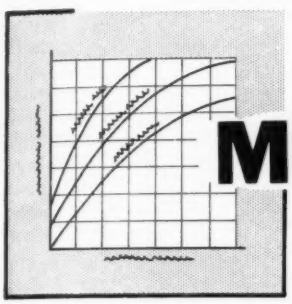
C. W. Torngren Company, Inc.
Torrington Company
Utica Drop Forge & Tool Company
Vacu-Blast Co., Inc.
Waterbury Farrel Foundry & Machine Company
Will-O-Hill Industries, Inc.
Worcester Pressed Steel Company
Yoder Company

— and most of them are well taken as having been instigated for worthwhile causes. And, just as there has been rudimentary thinking (and writing) in the area of "how to conserve engineering manpower by doing away with duplicate development work", something should be done along the same line for industrial methods. If Industry can fabricate by the best possible method, much material and manpower would be conserved.

The growing interest in the possibilities of cold forming, and the developments within the last few years along with the promise they hold, we feel, will be enough incentive for you to peruse through all of these articles. If time will not permit your immediate look at all processes, we have prepared a pictorial-index to help you go quickly to the process of your most immediate interest.

The cold forming processes which we shall now discuss are a reality — some have been so for many years. Watch for their further development and dominant role in tomorrow's metalworking activity.



METALLURGY

"If a metal can be said to possess malleability, it can be a candidate for fabrication by one of the cold forming processes."

ONE OF THE BIGGEST ADVANTAGES commonly attributed to working metal cold is the elimination of the costs and safety hazards commonly associated with the application of heat. This is, however, not always the case. Textbooks define "cold working" (cold forming) as the deformation of metal at any temperature below its recrystallization temperature.[1] Below is a table showing the recrystallization temperatures of some of the common metals in their pure form. From this you can see that whether an operation can be classed as cold or hot working depends on the recrystallization temperature of that metal or its alloy.

METAL	TEMP. OF RECRYSTALLIZATION*
Lead	Below liquid temperature
Magnesium	300° F
Aluminum	300° F
Copper	400° F
Iron	840° F

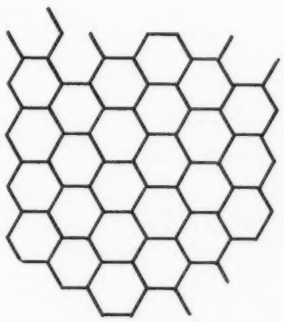
*Alloyed, these temperatures will vary somewhat.

The purpose of presenting this table is to give the reader an impression of the temperature latitude within which he might work his metal or metals and still benefit from the advantages of cold forming.

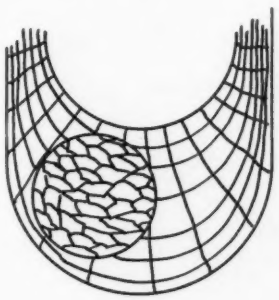
The improvement in metals as to desirable gains in mechanical properties due to cold working is directly related to the amount of deformation which takes place. Before you can understand this phenomena, you will have to know what takes place within a metal's structure. If you have had occasion to know these facts, perhaps you could use a "refresher".

In making the prime metal products such as bars, sheet, or strip, molten metal solidifies into minute particles commonly called crystals or grains. Impurities which have not been able to combine with the other elements are contained in the boundaries between the grains. Such impurities if present in excess have an adverse effect on cold-forming-ability.

When we order metal for our products, we specify one that will require a minimum of attention[2] to bring it to its point of high performance or sales potential. This point is



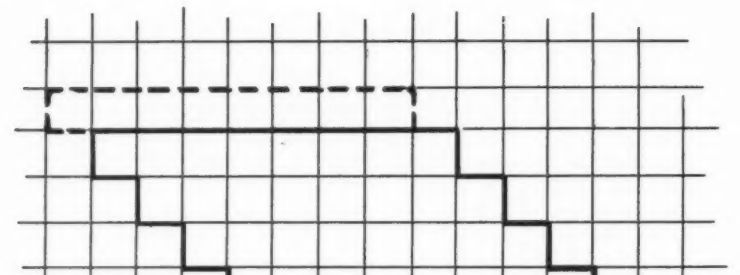
GRAIN ARRANGEMENT OF METAL IN ITS SOFT OR ANNEALED STATE



INSERT SHOWS GRAINS AFTER ELONGATION BY COLD FORGING. FIBER LINES CLOSE TOGETHER INDICATE AREAS OF GREATEST STRESS AND/OR ELONGATION

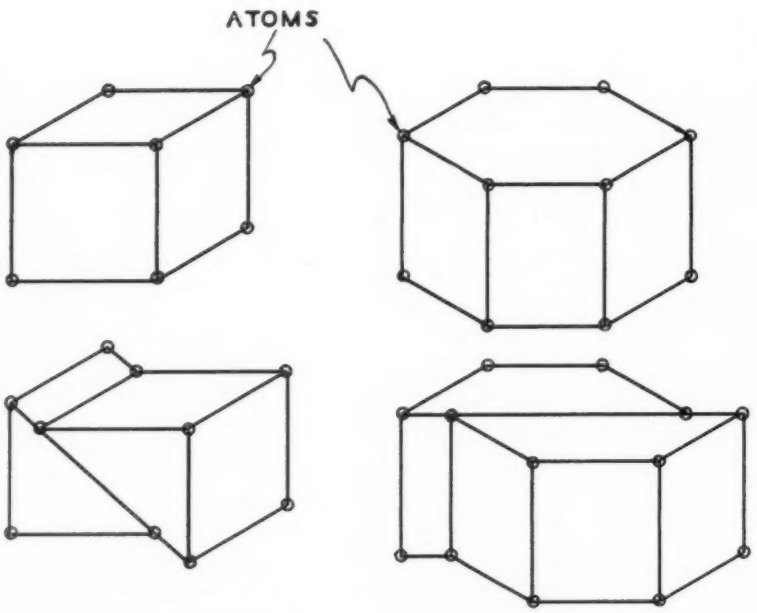
A metal that has solidified from a molten state, without stressing from an outside force, will exhibit like mechanical properties in all directions. In these diagrams we see an equiaxial grain structure on the left before stressing, and on the right the same alloy after cold working. The mechanical properties of the cold formed alloy will now lie exhibited in respect to the transverse and longitudinal axis changes.

It should be noted that metals have a grain geometry peculiar to themselves, and arrangements as regular as those shown do not exist.



DOTTED LINES SHOW POSITION OF GRAIN GROUP BEFORE COLD WORKING AND DEFORMATION.

This diagram shows the slip of a cube grain structure on itself, without cleavage within the individual grains taking place simultaneously. Actually, both phenomena do happen together when metal is stressed beyond its yield point.



GRAINS AT TOP ARE UNSTRESSED
GRAINS AT BOTTOM HAVE BEEN STRESSED

Cleavage, or a slipping of grains upon themselves, occurs when sufficient force is applied. Shown here are two common types of crystals (grains) of any metal whose grains are of these geometric shapes. They are shown before and after cleavage that may occur along any plane set up by the atoms in the lattice arrangement.

where the metal will perform satisfactorily as intended — brought to size and shape with proper internal characteristics. It is the amount of attention, with or without heat, that does the trick. Our present interest is with the approximate, if not the exact, metal shape and internal structure which will satisfy our need by cold working.

If a metal can be said to possess malleability,[3] it can be a candidate for fabrication by one of the cold forming processes.

PLASTIC DEFORMATION OCCURS because each grain of metal is made up of a number of atoms which may slip on each other at their boundaries, called cleavage. Also the grains can slip in their "slip planes" over each other. By force it is possible then to cause these grains to distort and to slip over one another to new permanent positions without rupture occurring in the metal. Besides their being bonded by "surface energy", these grains being regular in design are held together by geometric locking.

It is difficult to liken metal unto a liquid which, when under pressure, exerts this pressure in all directions. But when a metal is being cold worked, there is a **tendency** for grains to share the pressure being exerted. That is to say if one area is pressured, the metal will be compacted and will push out into less dense areas which will share the pressure. Internal pressures will never be equal for the whole mass, but they will have **approached** a superficial equilibrium. The approach to equilibrium is closest when performing operations like closed die forging where the metal is confined in all directions within the die.

The theory of slip planes and interlocking helps to explain the increase in tensile strength and hardness after cold forming. In the accompanying diagrams we see what takes place.

When cleavage and slipping of grain layers has been forced to the extent that further movement of this nature will no longer take place rupture occurs. But if the material is malleable and is handled properly, a great deal of reduction or deformation can be accomplished before this happens.

As mentioned above, grain areas will compress and slip until that area has work hardened and will deform no more. These areas then exert the pressure (if continued) on other more soft areas which also will be worked until hard. If desired deformation has not been accomplished in time, before all reasonable areas

in the vicinity have been work hardened, and continued pressure is exerted a rupture will result. This shifting on slip planes promotes further interlocking of grains (one area slips at one angle and other areas slip at other angles); these fibers slipping at angles to each other ram into one another and lock, making further slipping and deformation impossible without rupture. This then is what causes hardness and, consequently, an increase in tensile strength.

DEPENDING ON THE CHEMICAL COMPOSITION, metals will work harden at various rates of speed. Consequently some when being worked may require annealing between operations. Often several anneals will be necessary before the required deformation is complete. If annealing is not employed when needed between forming steps, rupture may occur.

Work hardening in some instances is desirable, but in others it may be detrimental. If a metal doesn't work harden fast enough, it may not reach its desired strength and hardness simultaneously with the desired shape. Whereas if a metal work hardens too fast, excessive annealing might raise the unit cost prohibitively.

Clean surfaces free from scale or impurities are important in most cold forming instances, as these conditions would cause pits or cracks which might be the start of a failure. Pickled or machined prime stock is recommended.

If, for reasons of machinability or lubrication, sulphur, graphite, or lead is added to the alloy the processing of the metal should be such as to leave these inclusions in nodular form, as sharp fragments would contribute to "notch-effect" or tendency toward brittleness.

By certain mill treatment, such as rolling in only one direction, preferred orientation of the atom planes can be had. This would be advantageous in processes such as wire drawing where fibering is expected in only one direction. However, cross-rolling may be necessary to avoid excessive preferred orientation; this metal grain arrangement would best be used for drawing of cup shapes, where randomness of atom planes is desirable to avoid "earing" of cups.

Cold working is practical at or near room temperature for the following alloys: aluminum, brass, bronze, copper, iron, lead, nickel, 18-8 stainless steel, low carbon steel (usually below 0.45% carbon), tin, titanium, and zirconium.

The following alloys do not lend themselves to cold working at room temperature: magnesium, molybdenum, high carbon steel, tungsten, and zinc. For these materials, somewhat elevated temperatures are required.

By experienced alloying and metal specification and then trial-and-error you can benefit from cold forming. You can mitigate your starting problems by understanding and a little study, or by the educated estimations of those familiar with problems such as yours.

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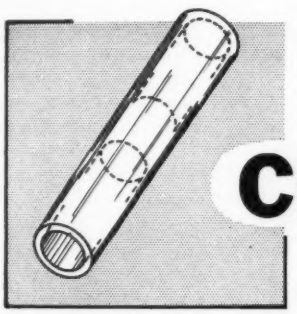
[1]Recrystallization temperature is that temperature at which a metal, if it has been work hardened, will start to return to its normal structure and exhibit normal properties. Working metal above this temperature is considerd hot working.
[2]Metal as we receive it from the mill is often not exactly what we need.
[3]The ability of a material to deform permanently without rupture.



COLD EXTRUSION

" . . . the only restrictions on the size of the extrusion . . . are the limitations of the equipment on which it is produced."

THE PHENOMENA OF COLD EXTRUSION can take place wherever metal is forced cold through a die by a ram or punch having sufficient pressure to plasticize it. With steel prices up, any relief from the burden of material cost is welcome. Shaping in this manner — without chips — not only saves on material costs but also provides savings by doing away with chip handling. For other advantages please refer to the metallurgical section of this report.

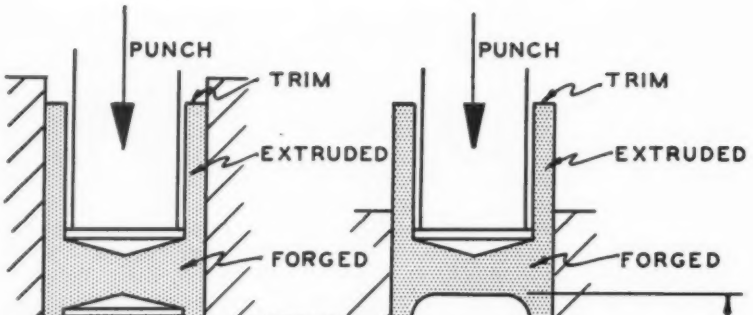
Dramatic examples of extruding machinery are becoming noticeable about the country — dramatic in size and also in that they represent "seven league" steps of advancement in the field of metal forming. Nonferrous metals have been extruded for years at elevated temperatures with smaller unit pressures. But now machines plasticize cold[1] steel and force it through a die orifice the shape of the desired part cross-section.

Extrusion presses capable of delivering 12,000 tons (that's 24,000,000 lbs) is the size class we are speaking of. It appears that the only restrictions on the size of the extrusion, lengthwise or cross-sectionwise, are the limitations of the equipment on which it is produced.

Even stepped extrusions are possible with recent developments in changing the dies after appropriate lengths have been extruded for each cross-section.

As in the other cold forming processes, the inducement of improved physical properties, without heat treatment, is possible. Other advantages are fine finishes without the necessity for further alterations by chip-making, draft-free parts, and close tolerances. Of no small value is the importance of the new freedom and flexibility of design available to the designer.

Cold extruded product properties easily compare and most often are superior to those of quality hot forgings. One of the main advantages being the lack of necessity for heat treat as the required strength and toughness is present in the as-extruded temper. Likewise, where a die cast aluminum part may exhibit 20,000 psi as a yield strength, a cold



SHOWING AREA RELATION. EITHER COULD BE HORIZONTAL

extrusion of the same alloy would show a rise in yield strength of at least 33%. For the most part all the common forging and hot extrusion alloys can now be extruded cold due to recent developments. There are still limitations but few in comparison to those of the crude cold extrusions of a short time ago. Large diameter tubes upward to 6' long, with thin walls, ribs, and complex bottoms are today commonplace from an extruder. Extruded finishes 10-100 rms are possible and usually eliminate further finishing. Polishing may be employed as well as anodizing, and plating offers superficial hardness desirable in many products.

LITTLE OR NO METAL IS LOST in this type of forming — the trimming of the butt of the billet, or the slug end is usually the only scrap produced. For the most part, there is a very nominal metal loss by subsequent operations due to the ability of extruding close to final shape.

A comparable cross-sectional area reduction by cold extrusion would be 45% to 90%. In drawing, regardless of the number of draws allowed in the comparison, these reductions would be very unusual. The big reason for more favorable reductions by cold extrusion as compared to drawing is that the extrusion is brought about by a compressive force and therefore the tensile strength of the metal is not a limiting factor.

Compared to drawing, another big advantage is the possibility of controlling the stroke of the press to give a heavy or thin section end of a definite dimension with a different wall thickness. In drawing, a designer is limited to an overall thickness which varies beyond his control.

In the vertical press type of extrusion (cups and cylindrical parts) the initial attraction was the ability to produce a straight round hole. The incidental, but now important, feature of increased strength has become a big attraction to the ever expanding hydraulic industry. Cheaper and better high strength containers are a must for cylinders, tanks, and accumulators. Also, the integral bottom is a desirable manufacturing savings feature for these components. Cylindrical parts lend themselves best to this method of fabrication, but success has been had with other shapes where radii are permissible and of ample size.

It is due to the hardening and consequent gaining in strength that allow fabricators to enjoy even greater savings in metal by being able to cut down the workpiece wall thickness. This usually has interesting effects on the end use of the part, on the companion components with which it operates, and on the area needed for its use. This area and weight saving is especially attractive to aircraft manufacturers.

Among the simplest forms of cold extruded parts are the various sizes and shapes of cans used by ordnance to make shells, projectiles, and rocket heads. Previous to and during World War II, most shell cases were turned on a lathe which was a very costly process from the standpoint of time and material expended.

A typical surface finish of 50 rms depends on tool finish, the percentage of reduction, the lubricant consistency, and the metal hardness.

LUBRICANTS ARE NECESSARY, but for the most part they are reclaimable. And although the application of lubricants for this severe service is more elaborate, the added expense is negligible in comparison to the advantages derived from this process. Early efforts to extrude steel met with the almost insurmountable problem of the metal welding itself to the die. This has been successfully dealt with by the development of lubricants of a special nature which have been made commercially available.

It is interesting to note that the Allegheny Ludlum Steel Corporation figures a 91% reduction by extrusion possible in 316 stainless, the hardest of the stainless alloys. Whereas in 304 stainless, a softer steel, **but with more carbon,** they can only plan on 76% cross-sectional reduction. Please see metallurgical article in this issue.

Practical tolerances are usually within $\pm 0.005''$ for a cross-sectional area, although with care and the use of a press of good register, greater accuracy can be realized.

At the initial contact, pressure to start the flow is most important. After flow starts, the pressure requirement then drops to much less to continue the flow and obtain the extrusion. And although we call this cold forming, great heat is actually created by the pressures used. The heat builds up as the pressure is applied to a peak in the neighborhood of 500° F in a fraction of a second depending on the material.

Dies and punches require an excellent lapped and polished finish for several reasons: (1) Due to the relatively high pressures involved, the workpiece finish is affected by any imperfection in the finish of the tool producing it. One would think that if the majority of surface irregularities of the punch or die were projecting **away** from the moving metal the part surface would not be impaired, figuring that the material being metal would not flow into these voids. This is not true, as the pressures are such that metal will flow into these minute centers, and as the metal is extruded further, these projections from the parent metal are wiped onto its surface, leaving marks. If the punch and die surface irregularities are predominantly of a **projecting** nature, these would then score the workpiece surface. (2) Good finish is insurance against splitting, cracking, or bursting of the punch. Just as bursting, a failure from the inside out, starts with an internal weakness (usually

an inclusion), so it is with splitting which must start with a surface imperfection. (3) Since the required pressures are high, any effort to reduce friction and save the full power for accomplishing work is worthwhile. Friction constants are raised considerably due to the pressures under which the friction occurs.

If a punch or die can take its punishment for a hundred extrusions or so, it will usually go the limit without failing. The limit may be 100,000 pcs[2] depending on the shape of the extrusions and the material. Unlike punches or dies used for hot extrusion, these tools are not subject to thermal shock[3] from the heat of the billet or slug against the interim cooled tool. This fluctuation in the temperatures of hot extrusion dies means a constant battle of internal fibers with external fibers since both areas are always out of temperature phase with each other. Punches and dies for cold extrusion are not plagued by thermal-shock-cracking caused by this stressing. It is well that they are not, as parts produced by this method are held to relatively close tolerances, and rework would be impossible without endangering the size of the extruded workpiece.

Items like spark plug bodies, automotive wrist pins, bearing caps, valve lifters, and high pressure containers can be extruded to close tolerances. To be successful commercially it was necessary to apply the proper tooling techniques.

SINCE COLD EXTRUSION EMPLOYS the greatest pressures of all press working, the tools are critical factors in successful processing. A high chrome-moly steel with manganese will give good die life, whereas high speed steels give satisfactory punch performance. An air hardening steel will give a die hardness of 60 Rockwell C. The high speed steel punch can be double drawn and nitrided to have a surface hardness of 70 Rockwell C.

To prevent bursting of the die a retainer ring of sufficient mass and hardness of approximately 35 Rockwell C should receive the die in a tapered nest.

Cold extrusion of steel alloys, for instance, deals with pressures upwards and beyond 300,000 psi. Working with these pressures, a high section reduction can be realized as well as exceptional tensile and yield strengths in the end product. Fine finish is also experienced. Since cold extrusions are usually shorter in length than hot extrusions, and the pressures employed are greater, huge mechanical presses of the vertical type are used for the most part. For ease of feed and ejection, however, there has been a trend toward horizontal multi-station extrusion presses. In this design the part is carried from station to station as it is progressively formed.

The starting place for the determination of press tonnage necessary to do a job would be tentatively set by the simple formula $P = A \times S$, where A would be the area to be worked in sq in and S would be the yield stress in psi of the metal to be worked.

Cold extrusion threatens to do to sheet metal stampings what sheet metal stamping redesign did to forgings and castings some time ago. The success of this change-over will depend on the education of engineers in this respect. They must be taught the advantages **and** limitations of the process.

It is likely that a sheet metal stamped part, although held to reasonably close tolerances, will be united with another to form a unit. The advantage of cold extrusion over this is that more often than not, the unit can be one piece with ever closer tolerances.

There appear to be only two drawbacks to cold extrusion: 1) All alloys cannot be cold extruded, and 2) springback must be accounted for. The fact that all alloys cannot be extruded at the present will adjust itself by further development, and springback is best handled by experience.

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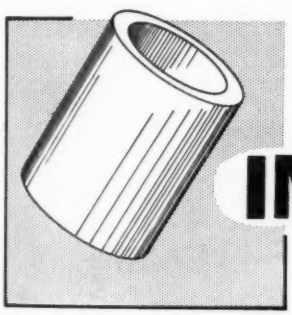
[1]Below recrystallization temperature.

[2]Tool alloys have been improved to give hundreds of thousands of extrusions where but a few years ago 10,000 pcs might have been considered good for any one job.

[3]Thermal shock plays hob with the surfaces of **hot** extrusion dies. Consequently, a periodic rework is a must to remove surface cracks that appear.



IMPACT EXTRUSION

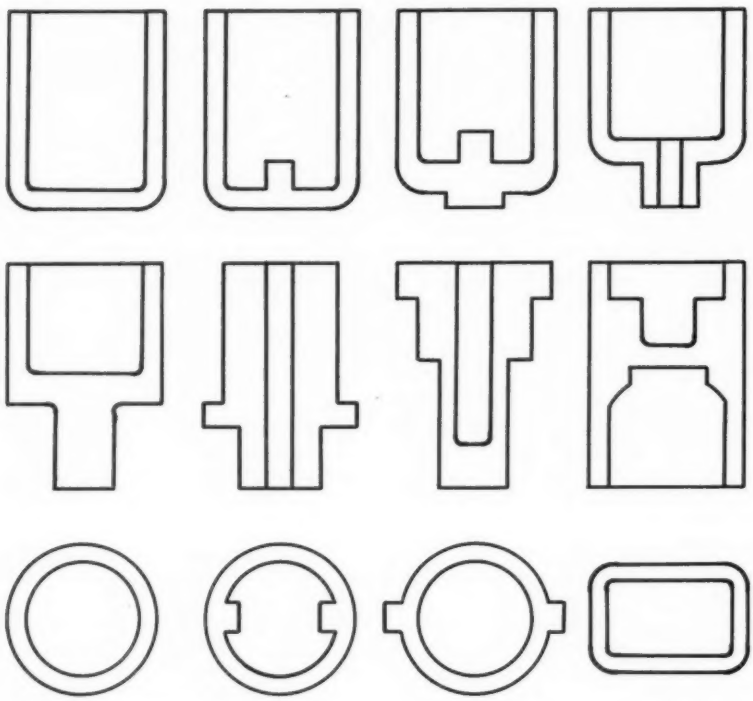
"One of the most important advantages is the possibility of high speed production for a low unit cost."

IMPACT EXTRUSION is usually thought of as a means of producing tubular shapes from a slug or blank. The slug is fed or placed into a die and struck with a punch. The speed and pressure with which the punch is brought to the slug must be sufficient to plasticize the metal and force it back through the annular space between the punch and die. If an open die is used, the metal is forced forward through the die as well as backward. The shape is then knocked out of the die or stripped from the punch.

This type of cold forming should be considered if: your part resembles a cup whose length is more than twice its diameter; when the base must be thicker than its wall, or a complex bottom is necessary; or where cross-section design is irregular with lugs, bosses, projections, or recesses. The advantages of this type of extrusion are many and some are of great importance to industry. One of the most important advantages is the possibility of high speed production for a low unit cost. Also the material saving is usually extensive since no chips are involved. Because there are no chips and no tool marks, a fine surface finish of 25 micro-inches is average, and even finer finishes are possible.

Die materials are available which

TYPICAL CROSS SECTIONS



offer excellent abrasion resistance and with proper lubrication give exceptional production. Uniform production is assured as all parts come from a punch and die of sufficient stability to withstand the pressures involved.

Impact extrusion enhances the structure by a homogeneous grain packing, and the elimination of porosity. Unlike drawing, there is no stretching as the metal flows under compression. Neither is there a cross-grain condition as with machining. Increased hardness and tensile strength, equivalent to those of high carbon and alloy steel, can be had by the cold forming of low carbon steel. Other advantages are freedom from draft angle problems and the accomplishment of sharp corner radii when necessary.

Any disadvantages of impact extrusion, we feel, are only temporary and will be overcome when more experimenting and development[1] have been done. Few alloys are being processed at present by this method; maximum size of part is determined by the press capacity available; and while dies and punches are comparatively simple and inexpensive, the purchase of a press can only be justified by a good-sized production expectation.

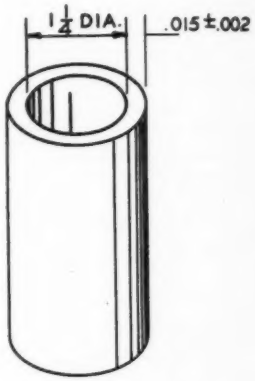
Impact extrusion is often called cold extrusion and not erroneously, as extrusion (the squeezing of metal through a die orifice) does take place in this process. General opinion has it that cold extrusion does not use speeds fast enough for the impact to be of prime importance in effecting the result, whereas the impact is of prime importance when backward extruding by this process. Actually, the term impact extrusion should be used in order to distinguish this process from other extrusion processes. We should note in passing that the word forging is sometimes used synonymously with extrusion. This is not improper either for in its true sense forging is the forming of metal by compression — a compressive force causing a plastic flow of the metal into the dies exerting the pressure. In impact extrusion a compressive (forge force) is most certainly used.

Impact extrusion principles, of either forward or backward extrusion, can best be shown by the accompanying illustrations. There are several methods used to bring about an impact product. Probably the most common method uses backward extrusion — a punch hits the slug and forces the metal as it becomes plastic back through the opening between the punch and the closed die. The shape of the die cavity controls the outside contour of the part while the punch controls the inside contour.

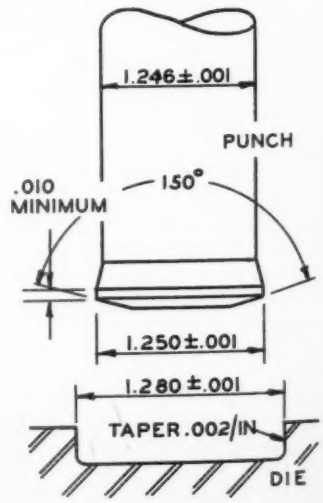
In forward extrusion, the die is open permitting the metal to flow ahead of the punch in the same direction. The contour of the die orifice controls the outside contour of the metal extruded through it. If the punch is fitted snugly in the die, no backward flow of the metal can take place. An inverted punch can be used to achieve any desired cavity in the metal extruded through the die orifice. In some cases, the slug is made with a through-hole permitting a plunger on the leading end of the punch to enter the die ahead of impact and control the inside contour of the workpiece.

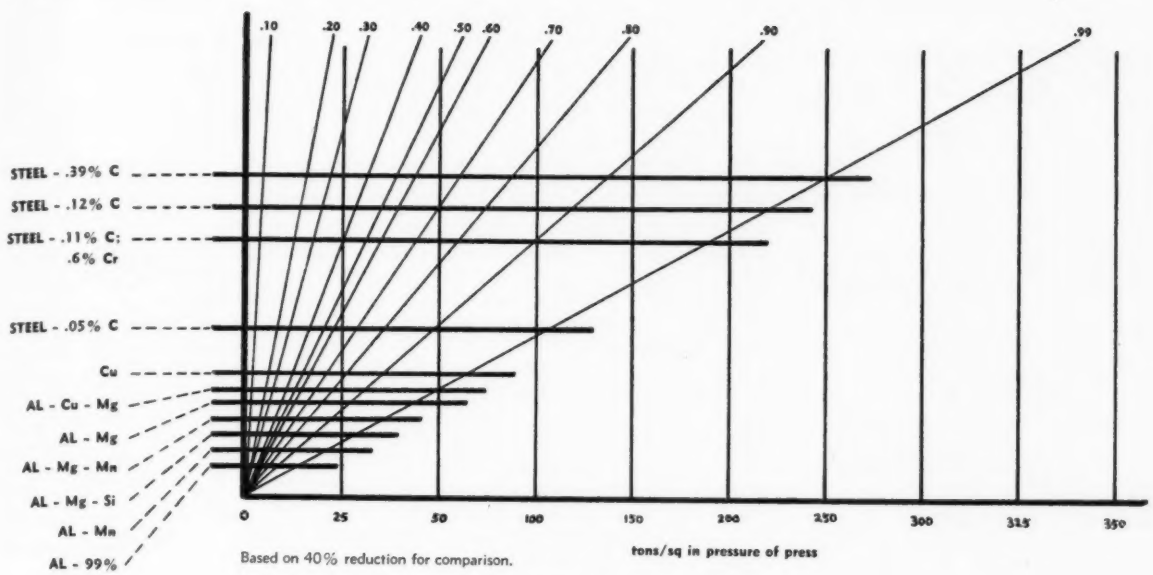
In backward extrusion the walls are of a necessity uniform whereas with forward extrusion it is possible to achieve a taper when desired.

If wall thickness concentricity is of extreme importance, your best consideration will be to force the metal forward over the inverted punch. In this instance, the punch can be fastened to the bed of the press and being more rigid offers a



WORKPIECE

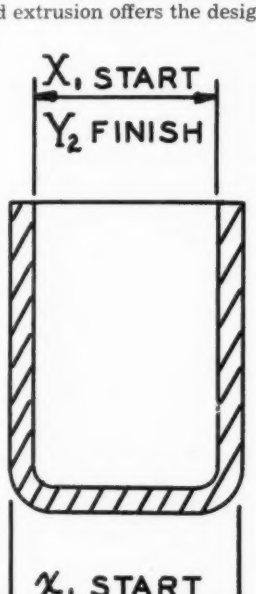




A rectilinear chart to give you the approximate pressures required for forward extrusion.

more uniform wall thickness. This however, requires a more complex tooling as the die must be arranged to move out of the way or open up for part removal. Sometimes the advantages are lost because of this.

The combination of backward and forward extrusion offers the designer



$$\text{CHART VALUE} = \frac{Y_1^2 - y_1^2}{X^2 - x^2}$$

no end of imaginative possibilities. Asymmetric parts are well within the range of work, as well as ribbed, flanged, and a surprising number of other shapes that would appear to be possible only by casting.

ONE OF THE BEST EXAMPLES of the usefulness of impact extrusion is the simplifying of an assembly in which a bottom has been previously welded or brazed to a cylinder. The joining of two components always involves the possibility of leaking or weak connection. These risks can be eliminated by a one-piece impact extrusion produced by a single operation — usually at less cost. The side wall of the extrusion will be of uniform thickness in contrast with the tapered wall of a drawpiece.

One of the most practical developments of impact extrusion to become a reality is a continuous aluminum can machine which forms a seamless can with every blow of the punch. Work is being done now to make the process continuous to the extent of pouring molten metal into a continuous strip from which slugs will be punched and then struck into cans. Hydraulic presses may in many instances be used for impact extrusion. But the mechanical press is favored because of its speed (which impact depends upon), its lower maintenance cost, and lower capital outlay. It should be hurriedly stated however, that hydraulic presses offer the most versatility, control-wise, and that greater stroke lengths are available.

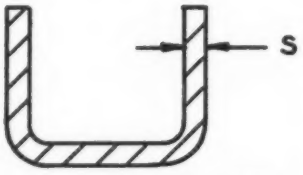
Depending on the unusual nature of the part geometry, its type of fabrication, and whether or not experienced personnel can be consulted, much development work can be eliminated. Those who are considering this process for the first time may, as a starting place, find the tool tolerances in the sketch helpful. The maximum length to diameter of the punch is 3 to 1 for the backward extrusion of steel. Ratios of over 10 to 1 are possible for aluminum.

The limits for forward impact extrusion seem to be only that imposed by the equipment available — clearance below to accommodate the extruded part, and pressure capacity.

In the more conventional impact extrusion where the metal flows up the punch, a long stroke press may be necessary for parts of inordinate length. However, the longer the punch the more difficult it is to hold concentricity.

Because the metal is caused to flow in the direction opposite the impact force, a press of greater pressure is required when backward extrusion takes place. By the same token, in forward extrusion the punch pushes the metal ahead of it and for all practical purposes the operation can be performed on lighter equipment.

There has been much pioneering in the last few years in developing new machinery and modifying standard machines. One fabricator needed more pressure than that rated for his Bliss 308's. His part specification had been changed to a thinner wall thickness. He was able to get the added



$$\text{CHART VALUE} = \frac{L}{S}$$

pressures by increasing flywheel size and reinforcing the frame.[2]

Exact pressures required for impact extrusion are difficult to figure. They are functions of the projected area of the slug, the reduction in area of the formed part, and the yield point of the product metal. Forward extrusion when "impacting" requires about one third the pressure necessary for extruding backward — for comparable metal and part configurations. Please see graphs.

Impact extrusion effects great compressive forces on the tool which are not present in drawing techniques. However, the shear stress in both processes may be comparable in some cases. Since compressive forces are high in impacting tools, their surface hardness must be of sufficient depth to prevent incipient collapse. At the surface, a hardness of 60 plus Rockwell C should be had for good service. A good balance of hardness and toughness must be had at the core, to resist bursting.

The die ring is usually shrunk into a tough backing block of less expensive steel which provides the mass to absorb the shock and resist bursting. The tools which come in contact with the work are generally high carbon — high chrome tool steel; solid carbide gives excellent life and finish if the production is high enough to warrant the cost.

THE PROPER LUBRICANT is especially important in impact extrusion as the pressures are higher than with most other forming operations. The lubricant must be able to withstand these pressures and sudden rises in temperature.[3]

Lubricants are: for lead — water, mineral oil, vegetable oils, or castor oil with talc; for tin alloys — mineral oil, corn starch with olive oil, and also vegetable oil and talc; for aluminum — lanolin based lubricants which are predominant, lard oils, and commercial greases. Graphite or phosphate coatings are usual where moderate elevated temperatures are helpful e.g., magnesium alloys employ elevated temperatures when "cold" formed.

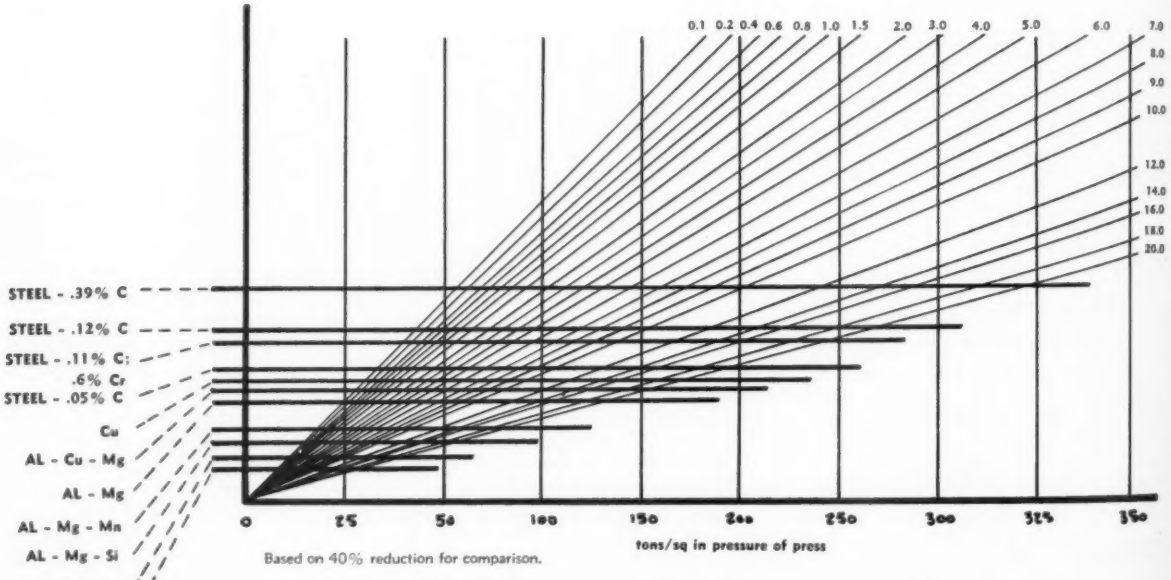
Steel requires a different treatment than other metals that are just merely coated. Steel should have a phosphate coating applied after a thorough cleaning process, or a coating of copper will aid in the retention of the outer lubricants mentioned above.

Sodium, potassium, or naphthene soaps; emulsions with fatty acids in a free state; and a number of commercial preparations should be explored if you are considering impact extrusion.

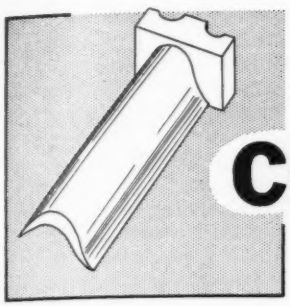
[1]The production of collapsible tubes to dispense pastes has been going on for many, many years. With the introduction of new metals and the influence of our competitive economy, we shall see many more new and startling realities in this field.

[2]As the wall thickness decreases the pressure requirement goes up. We learned from the metallurgy section that work hardening rates vary, and, as a general rule, you can expect pressure requirements to vary directly with the amount of reduction. For example, compare reducing a slug to a cup having a 0.062" wall thickness and one having a 0.004" wall thickness. The pressure requirement differential to flow metal through a 0.062" opening between a punch and die, and a 0.004" opening, will be great.

[3]Due to internal friction and severe metal-to-tool frictions, the temperature may rise several hundred degrees but seldom reaches the recrystallization point.



A rectilinear chart to give you the approximate pressures required for backward extrusion.



COLD FORGING

"Just about any part . . . of a compact nature could be produced by this process when Industry is ready to try it."

IF A METAL PART or component requires the mechanical properties of hot forgings with its usually required heat treatment — consider cold forging.[1] By taking advantage of the work hardening effected by working the metal cold, a less expensive stock can often be used to gain the advantage of heat treating more expensive alloys.

Cold forging is a squeezing operation where compressive stresses are introduced. The three most common types of forging machines are hammer forges hydraulic presses and mechanical presses.

Although the mechanics of the cold forging process are very similar to those of impact extrusion, and both can be done on the same type of equipment, their general connotations are different. Impact is employed — certainly not exclusively, but until recently and for the most part — with relatively thin walled components; whereas forging is associated with thick walls, and shapes other than cans or cups.

The big benefits from cold forging are close tolerances and fine finishes. Also due to excellent fiber flow, the metal gains strength, and distortion is held to a minimum by avoiding heat treatment in most cases. Soundness is shown in fatigue tests where small grain size is indicated, a lack of internal porosity and the lack of cracks are also evident, as well as a balanced stress condition.

Forgeability depends on a metals grain size and mostly on its freedom from inclusions or segregations. Other considerations are the operation conditions — temperature of metal and how worked, and the condition of its mill or prepared surface.[2]

Since strength is with the direction of grain elongation, it is important that this be considered in the orientation of the slug to its forging die or dies to take advantage of this. In many instances, this is so important that fiber flow directional relationship is often written into the part specifications. Grain refinement and porosity elimination are other advantages of cold forging besides grain orientation.

If the fabricator has a selection of methods by which he could forge the part, it will help him to select the method which will give the optimum in property performance if he knows something about the service expected of the part and its stress or load conditions.

As in all cold forming processes, cold forged parts have grain elongation and flow — in the direction the metal is flowed. This following of the surface direction change adds strength to these areas which are normally weak, especially when specifications call for small radii.

In forging, the plastic deformation takes place with the grains elongating or being flattened so that their short axis is in line with the direction of force. This is so, within reason, as some of the die contours do not react on the workpiece exactly normal with the lines of force.

Generous fillet radii are recommended in order not to cause "cold sheets" — the condition caused by the metal being squirted past a sharp radius and not returning to fill up the by-passed cavity between the die wall and the forging wall.

Two parts are shown here which could be made from forgings and then finish machined. It is obvious from fiber direction lines which part would offer the greatest strength. In 1) we see a part forged to near size all over and finish machined, where 2) is also forged to dotted line, and then machined.

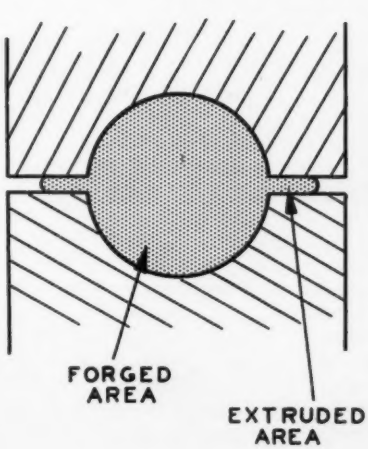
Many metals when hot, oxidize to the extent of producing objectionable surface scale — especially in the above recrystallization temperature ranges. By cold forging rather than hot forging, scale can be eliminated and surface finish can be optimum for the sake of appearance and the avoidance of failure points. For example, by cold forming zirconium the surface oxides, carbides, and nitrides usually produced by hot working are not present. The surface is good and tolerances are close.

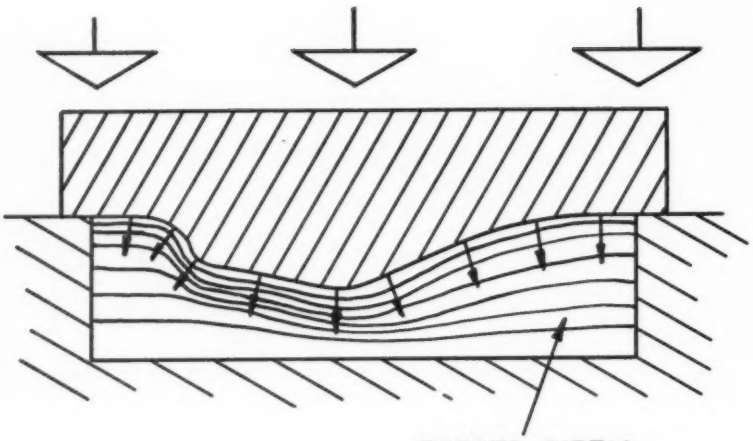
Heat treated carbon steels as a rule have lower values for elongation or contraction than alloyed steels of high tensile strength. If a steel shows a contraction of at least 5%, it can usually be deducted that it will have good forgeability and cold forming properties.

Some metals such as magnesium alloys do not forge well in open dies and have to be preformed on a press and then forged by hammering in a confined die to avoid cracking. Then too, if a hydraulic or mechanical press of sufficient "oomph" is not available for finish forming, the finishing would be done by hammering.

Forging is usually thought of as working a metal to shape by its being confined between dies where dies are forced together either by a single stroke or by repeated blows. It will be interesting to watch the various roll-forging methods now under development.

JET ENGINE COMPRESSOR BLADES require high strength per-





ARROWS IN WORKPIECE SHOWS DIRECTION
DIVERSION OF INITIAL FORCE

formance. All must be able to withstand the expected forces or the engine will fail as a whole. To improve grain structure and reduce the possibilities of failure from inclusions or surface flaws, the airfoils are being cold roll forged in a gap mill as one method of fabrication. In steam hammer, hydraulic or mechanical press forging, the workpiece is hit between dies to form by compression. So it is with roll forging — with the exception that the compressive force is delivered through rolls. Forming is still by compression.

The rolls are run in a "stand", similar to that used in a "rolling mill" with the desired airfoil profile in and/or on the roll surfaces.

Depending on the material and the blade contour, it may be necessary to pass them through the rolls more than once. If this is the case, annealing operations may have to be interposed to remove temporarily the desirable work hardening stresses.

"Cold Coining",[3] another forging operation performed on a conventional press, is used to bring the blades to their final size.

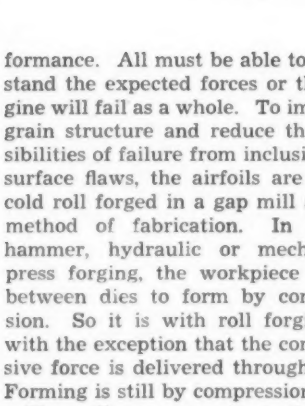
In impact extrusion part of the metal is forged (compressed into shape) while other areas will be extruded (squirted or flowed into place). With cold forging we think in terms of heavier sections where metal has been shaped by compression.

In coining operations the metal flow is limited to short distances within the die — usually not past the intended confines of the cavities. For the most part the metal only flows on the surface for slight contour changes. Embossing is a type of coining where raised or indented letters or designs are imparted to the surface.

We can then generalize that, providing the material characteristics indicate malleability, any part within the pressure capacity[4] of the machine can be cold forged. It is a certainty that as larger, more powerful equipment becomes available, more and more work will be cold forged — completely, as a first operation, or as a finishing operation.

There is much room for development in the cold forging process. Just about any part which could be considered of a compact nature could be produced by this process when Industry is ready to try it. Obviously some parts may have to be redesigned to lend themselves more readily. For the time being, on many parts which the more enterprising Industrialist would like to produce now by this method, he will have to be satisfied to use it for only a first operation while developments "stew" themselves out. New and ingenious developments in tooling are needed over and above those that are now a reality, and someday they will be at our disposal. Will you wait for them, or will you participate in their growth and profit early?

[1]Cold forging is working metal at temperatures below the recrystallization temperature. Please refer to section on cold forming metallurgy.
[2]Forging stock may be a billet which has been extruded and already has a fine grain or it may be cast stock.
[3]Coining is a type of forging most often used as the finishing operation after a succession of preparatory forging operations. It is the sizing operation of forging.
[4]Much hot forging today is hot forged rather than cold forged because of the bigger pressure necessary for cold forging. This will be corrected as developments take place and machines become larger.



COLD HEADING

"A reduction in piece price is not the only gain to be realized when changing over from a machined part to a cold headed part."

THE READER MAY FIND IT IMPRACTICAL to learn all the intricacies of cold heading unless he works regularly with it or with products formed by this process. However, it would be wise to be familiar enough with the possibilities therein to recognize whether a part can be cold headed. It is hardly possible to set up material and processing specifications until the method of fabrication has been established.

The material, the complexity of the part, and the number of secondary operations will help determine if cold heading will pay off. As a general rule, if the number of pieces is in the neighborhood of 25,000 you can consider heading for economy. This number can be run off in one

day and you can still make out on the setup time. Whether or not you can pay for the dies with this short run depends on the complexity of the die cavity.

Fabricators of cold headed parts say that if a part looks at all like a candidate for cold heading, its design should be explored with specialists. A short consultation before the design is frozen may better the design or correct it for heading.

Correcting a design for heading is not always necessary as eccentric formations can be done successfully, but the easiest to handle are those which are symmetric to all axes. Sharp corners are difficult to fill out whereas generous radii add to the flow possibilities. Also, if the upset cross-section is to be square, the use of a square drawn stock will give an upset requiring the least amount of trimming. However, this may not be feasible if extrusion is a function of producing the part.

Consideration should be given to assembly-design improvement, where great savings may be realized by the use of "specials" cold headed for the job to serve a dual purpose and reduce assembly time. Their use will often permit automatic assembly for extra cost reduction revenue. For example, fasteners can serve as feet, spacers, pivot points for other components, etc. In order for this to be a reality, it is necessary to establish whether or not the added expense of a shape change is prohibitive in terms of the gain. Companion parts may also require changes, although this is most often offset by the fact that other parts may be eliminated.

In general, the cold heading process is applied to materials which are considered malleable when cold — carbon, stainless and alloy steels, copper alloys, and aluminum alloys. Although malleability of the metal is the prime requisite for cold heading, this doesn't mean that the metal must be dead soft[3]; some previous cold working of the stock is usually advantageous to prevent buckling, folding or bursting from imperfections within the structure. Tendencies toward good gathering or upset proneness is desirable when choosing a metal, but for parts where upsetting will be used along with machining it may be necessary to sacrifice some heading ability for machinability.

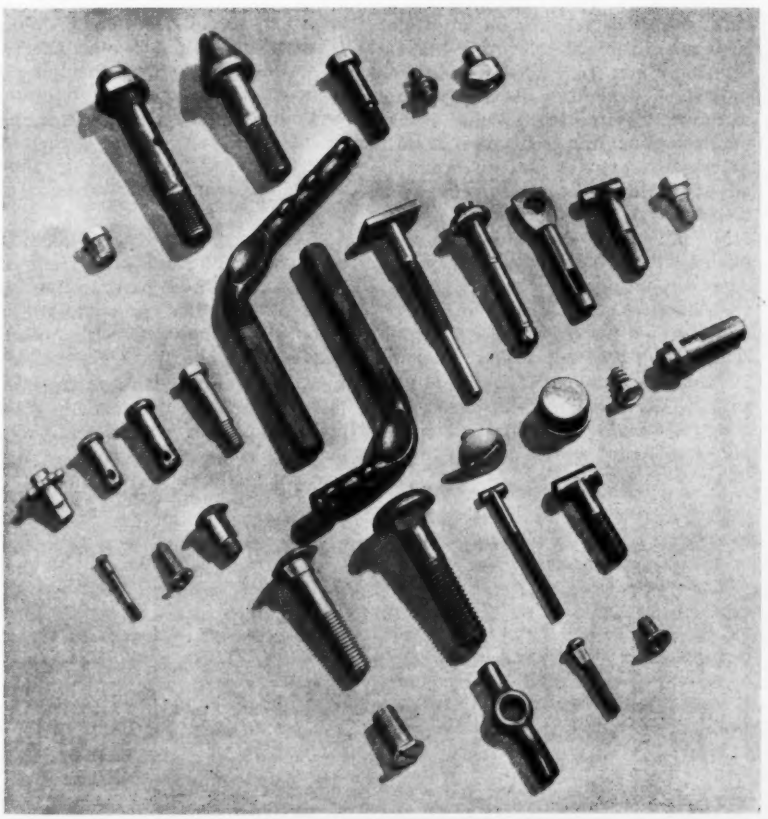
HERE AMONG THE HEADING PROCESSES, we hear the word extrusion, which points up the popular conception that extrusion is accomplished when metal is forced through a die. This is not to say that extrusion is heading[2], but that extrusion is one of the operations which can be performed — along with heading — in the same machine. In modern heading developments, extrusion is one of the multi-process fabrication techniques. In the making of hex head bolts for instance, the shank is extruded twice from a specific diameter to a smaller diameter below the head, and then to an even smaller diameter for the threaded portion if thread rolling is to follow. By extruding certain areas and heading others, a shorter stock length can be used due to the larger diameter wire providing more volume to fill out the head. By compressing a shorter length to form the head, there will have been less distortion of the grain pattern, thus offering greater resistance to shear or cracking.

Along with shear and crack resistance, the compressive force involved in heading engenders a surface refinement which alone offers a tremendous increase in strength. And the internal structure having been moved but little, the material's ductility is retained for what is known as toughness.

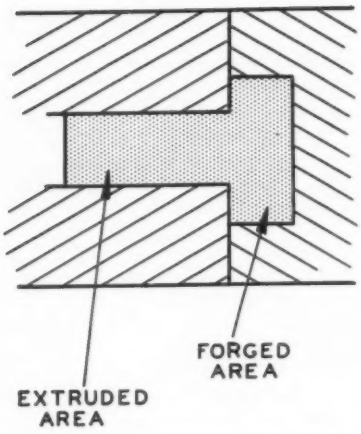
Ball heading is an interesting example of the versatility of a heading machine, e.g., the production of tips for ball point pens at the rate of 400 per hr. Production ranges from this extreme on one machine to the other extreme of heading balls over 1" dia.

The manufacturers of rolling equipment for on and off the highway vehicles are taking advantage of heading the ends of their driveshafts before imparting the splineform to these ends[3]. By upset forging, they are able to predict and expect longer life due to the lack of fatigue failure which is often experienced from surface flaws caused by chip making methods. Another prime example of the double-end heading which can be done is performed on overhead valve push-rods.

Most metals can be cold headed if alloyed for this purpose. In other words, cold heading stock should be used. This heading wire should be of a high quality as to surface finish and have a minimum of internal inclusions. No folds or scratches are allowable which could start fracture, shearing, or bursting. The specifications might read: Bright Drawn Open Hearth Basic Steel[4] (if the product to be headed is to be made of steel). Wire tolerances are usually specified (premium price) when ordering, or the product and dies can be designed



Typical Heading Examples



around commercial tolerance stock. When ordering, it is good to tell the supplier what the stock is to be used for.

HEADABILITY IN STEELS is governed by the carbon content. This is true in plain carbon or alloy steels, and generally a percentage of 0.40 carbon is as high as most compositions can go and still handle well in a header. The free machining steels do not offer good heading possibilities as a rule because of the inclusions of sulphur having been added to enhance machinability.

Austenitic steels and some nickel alloys have a high work hardening rate and give trouble on multiple blow machines. Metals of this make-up sometimes require intermediate anneals — depending on the amount of reduction expected. Where intermediate annealing is necessary, single stage machines can be used to advantage and the parts processed step by step. A batch will be run off with one set of dies and then annealed, after which the batch will be run through for successive operations with another set of dies.

Alloys employing lead in their composition are not easily headed. In fact, copper alloys having as much as 2.0% lead can only be upset by about two diameters, whereas copper alloys with no lead can be upset over three diameters.

Aluminum alloys, as other metals, are chosen for their mechanical properties to be exhibited in the performance of the finished part, i.e., lightness, corrosion resistance, or resistance to elevated temperatures in service. Most of the "S" suffixed aluminum alloys are well suited to cold heading; some, however, due to their low shear strength may be limited as to the heading diameter ratio.

For parts requiring extrusion as well as heading, a wire which has been lubricated (coated) can be supplied. Many bolt makers use this coated-with-lubricant wire for all of their work, particularly with solid dies to prevent scoring.

In the illustration to the left, we see a blank which has been upset in the first operation, the one on the right is a finished piece. It may appear that the slight upset achieved in the first operation is too slight to be of consequence, but this is not so as the first upset or coning operation determines the flow lines in the head. The symmetry pattern, if good, will preclude the possibility of lapping, weak spots, or cracks in the final product.

As there are many types of machines within a family, so it is with headers. There are single and multiple blow headers as well as progressives and specials. The term "blow" is really not an impact blow as much as it is a fast squeeze, causing metal to flow into the die cavity; it could be likened unto a closed die forging in that the exact amount of metal to fill the cavity has been pre-arranged and made available — no more, no less.

Heading machines can handle a wide range of work sizes from unimaginably minute parts to the huge bolts of 1¼" dia. In necessary instances, tooling can accommodate headed parts over 5' long.

Cold heading machines are much faster, by nature, than machines that make chips and can be counted on for at least a 25% savings in time cost and material cost. Nut making machines (a form of a header) can save over ⅓rd on material alone by eating up round stock in place of the hex material required for making nuts on a screw machine.

Headers fall into two categories: 1) the open-die type, and 2) the closed-die type. In the open-die header, long workpieces can be headed due to the advantage of the opening of the die allowing the work to fall and be pushed out. This feature also permits a partial cavity in all four sides of the die, and by rotating the die to new cavities when the old ones are worn phenomenal die life can be realized. The only objection is that a die parting line will be left on the workpiece; however, in many instances, this is small and is not detrimental.

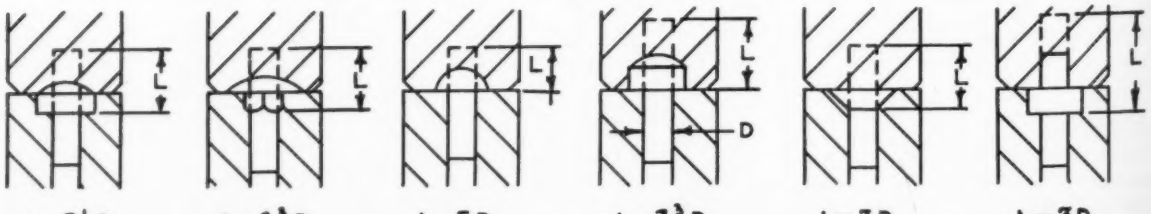
The closed-die header offers parts without marks, and too, the machine adjustments are less tedious. It should be noted that the life of a closed die is only 25% as long as the life of the open die and is more difficult to sink, especially where under-the-head configurations are needed.

The progressive type header is in many instances doing the work of the three-blow machine. In the progressive type, a slug is reduced in a series of in-line dies. The part is formed in several distinct operations and six stations are not uncommon in progressive headers or transfer machines[5] of this type.

A REDUCTION IN PIECE PRICE is not the only gain to be realized when changing over from a machined part to a cold headed part. All new configurations added to a redesigned part are free after the dies have been paid for. And although the more complex the die the higher its cost, when the price is spread over thousands of pieces it makes any cavity addition cost seem almost negligible.

As a general rule, in low carbon steel a one-blow machine can head two times the diameter of wire; a two-blow machine can head approximately four times the wire diameter (Fig. 4); and a three-blow machine

LENGTH TO DIAMETER RATIO ON A TWO STROKE HEADER



can handle six times the wire diameter as to headed length.

Heading can take place anywhere along the blank length and at speeds of several hundred per min depending on the qualifications of the machine and the configuration of the piece part. For some shapes a savings could be realized if the quantity were only 5000 pcs. On the other hand, a large run of several thousand pieces may justify carbide dies.

Another economic facet of the heading machine is the ease with which it can be fitted with auxiliary features and attachments. One of these money-saving devices can draw low priced hot rolled steel at the header just before heading. The stock price differential is a worthwhile consideration plus the advantage of heading with less pressure and being able to realize better plastic flow.

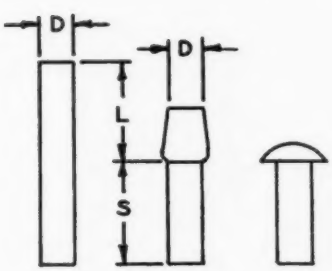
Automated feed lines feed headed parts right into secondary operation machines for slotting, threading[6], trimming, pointing, grooving, drilling, milling, and grinding. These developments permitting greater flexibility have furthered the trend toward using cold forming for initial operations.

Another important assist in the form of integral apparatus can be had with the coil straighteners used with a header. This is especially important when using large wire around 1" dia.

Die life has been steadily increasing and shows even greater promise with the continuing developments taking place in mill fabrication. This increased die life along with new sinking techniques effects new savings, but most of all assures uniform production.

Nearly all suppliers can furnish steel for satisfactory die making. However, the best of steels will not mean long wearing dies if the proper heat treat is not used. Strict adherence to the appropriate handling of a particular steel is paramount and is worthy of experienced handling. The closed die types especially require expert handling and special fixturing for the proper quench of the cavity.

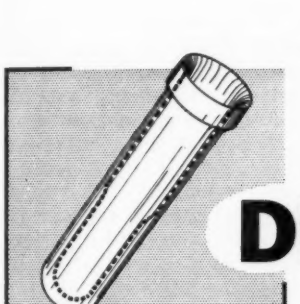
An extra bonus to be had from cold heading, besides stronger pieces at lower cost, is aid with your quality check. This is to say, if a metal is unsound before heading the inclusions and flaws will likely distort and open up to the surface when headed. These rends in the surface can then be detected during your quality control procedures and discarded.



STROKES	L
1	2 D
2	4 D
3	7 D

LENGTH TO DIAMETER RATIO. VARIOUS MACHINES

[1]Dead soft metal is metal in its softest most ductile state. Steel is considered dead soft if it has less than 0.10% carbon and is annealed.
[2]A squeezing compressive action like forging.
[3]Heading operations are often first operations where finishing has been planned for other machines to complete the part.
[4]Other wire which has not been drawn, but which is thoroughly pickled and cleaned, can be used for open die work, but the large tolerances used by the mill usually prohibit this.
[5]Transfer headers using double extrusion techniques and multiple blow headers are necessary for the more complex contours and instances where work is done at several places along the blank.
[6]The latest heading machines of a transfer type give a complete part with each stroke, including the rolling of the thread.



DEEP DRAWING

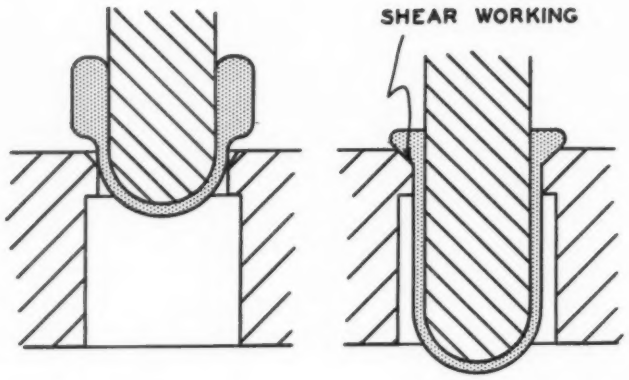
" . . . offers . . . more than just a desired shape which would have been difficult to produce by any other method."

THE ORIGINAL AND PRESENT MEANING of drawing is to form metal by diminishing the periphery of a blank as metal is drawn into a die. Other drawing, used in this sense, would be those operations performed by drawing metal into a die as well as shearing it ahead of the die edge — the part starting as a heavy cup in this instance. Here the metal is not thinned so much by stretching but by a shearing action which redistributes the metal along the punch by the use of higher pressures. Please see illustration.

The deep drawing which takes place with a flat blank, or a cup from a previous sheet metal drawing operation, is cold working. And there are advantages to be had from forming metal cold as you will note in the metallurgy section of this package. The working (stretching) here is not as severe as the forming by shear used when the cup blank is heavy walled and when there is no draw ring.

It seems necessary for purposes of this paper to make the above distinction, and we shall be referring to both phenomena under the terminology of "deep drawing." Neither nationally nor internationally does there seem to be any distinct or accepted terminology for this process. "Deep drawing", "drawing", and "pressing" connote different things to different people. However, the deep drawing of metals, as we shall call it, offers the fabricator more than just a desired shape which would have been difficult to produce by any other method. A phenomenal increase in strength and hardness can be obtained by working the metal in this manner.

Trial and error tempered by experience play a big part in approaching



TO SHOW SHEAR ACTION IN DEEP DRAWING
AS COMPARED TO STARTING WITH SHEET AND STRETCHING

the optimum in strength, if strength is a factor of design. An understanding of what takes place will help eliminate false starts and veering from the most direct route to your solution.

Since the word drawing usually connotates the forming of cup-shaped parts from sheet metal, it should be noted that drawing as a second operation has become widely used since improved extrusion techniques and extremely heavy presses have come into being. The development of heavy presses is playing this dual role in the advancement of deep drawing techniques since high pressures are necessary to effect the heavy reductions involved. Also extrusions now being used for first operations were not available as blanks for deep drawing.

In sheet metal drawing the pressures are applied slowly, but as the reduction of previously extruded parts is often greater, the shearing action mentioned above makes it necessary to speed up the action. Increasing the speed gives impetus to the final carry-through of the punch. As the action is speeded up, it may become necessary to re-specify and sometimes settle for an alloy with modified mechanical properties in the final product. If carbon steel or alloy steels that work harden at a faster rate are used, cracking may result if the percentage of reduction is too high and the speed too slow.

THE IDEAL CONDITION TO LOOK FOR in a metal to be drawn would be one having a good balance between tenacity (ability to transmit stress without "necking") and ductility (ability to flow).

The negative approach in selecting a drawing material can be used. Here we would select a material by looking for metals as free as practicable from negative properties, namely, metals without internal or external discontinuities, chemical segregation, unsuitable crystalline structure, physical property variations throughout, directionality (preferred orientation), aging (grain growth or reorganization), surface imperfections, or variation in thickness.

It is important that the material to be drawn have the proper mechanical characteristics. For instance, a grain size that is too large may cause an "orange peel" effect resulting in excessive polishing where finish is important. Too small a grain size will lessen the ductility of a metal and cause undue annealing operations. Although a fine grained metal will produce a finer finish, the purchase of the proper stock can easily offset the cost of excessive interstage or final corrective processes.

Metals of good drawing quality are those metals which have a good range between their tensile strength and their yield strength. If the stress in drawing doesn't pass the yield point there will be no permanent deformation, but if the stress is too great the metal will rupture. Therefore, ideal drawing conditions are approached as the differential between yield and ultimate strength increases.

Probably the majority of steel parts are drawn from low-carbon steel — a carbon range of 0.05% to 0.25%. These steels are the most available and the most reasonable in cost. It can generally be said that as carbon increases, drawability decreases.

One of the main advantages of using low carbon steel for drawing is that it will harden from cold working and heat treat can often be eliminated. Along with this advantage, low carbon steel can usually be worked more severely before hardening sets in, whereas the alloy steels and high strength steels are more sensitive to cold working and interstage annealing may be called for.

Since the behaviour of metals as they are pressed is determined by a combination of favorable and unfavorable factors, it is practically impossible to predict exact results. Only experience and trial can offer desirable results.

THERE ARE FOUR GENERAL CLASSES of lubricants used in deep drawing. We will speak of the classes as there are so many varieties within each class. By narrowing it down you can find the one to suit your needs. There are straight mineral oils, fatty oils, solutions or emulsions of soluble soaps and oils, and the so-called drawing pastes or compounds.

For drawing the non-ferrous metals the mineral oils find wide application, and they are easy to apply and remove.

The second group, fatty oils, are compounded in great variety and for the most part have a higher film strength. Consequently, they are best for the more tenacious alloys. Be advised that they often leave stains.

"Suds" or the soap lubricants are easy to use and are usually selected for light "pressings" or light drawing. However, many additives are now available which take them out of the "suds" work classification and into a more strenuous work area.

The paste group is often applied neat (as is) for very severe draws but can be broken down with oil, water, or many of the above components to suit a particular requirement. Their base is usually chalk for the purpose of mechanical separation of the metals. This filler also helps the true lubricant from being squeezed out.

A lubricant is usually a necessary evil. Its efficiency and helpfulness varies inversely with its ease of removal. And generally the heavier a lubricant, the more difficult it is to remove. Often a high pressure spray or some mechanical means of removal must be employed. Consideration of the method of removal of a lubricant should be coincidental with its being selected.

Although it is our premise in these articles to laud the advantages of

cold forming, we do not wish to misguide. Where deep drawing is to be a second operation it may be wise to consider performing the first operation by an appropriate hot forming method.

Cases arise whereby the unsymmetric shape of the part brings about more concentrated stresses in some areas than others. Consequently the work hardening which takes place in these areas may cause cracking. If this is the case, it may be desirable to anneal before this second operation or hot work the first operation to avoid work hardening.

METALS WHOSE YIELD STRENGTH approaches their tensile strength are poor candidates for drawing as there is little latitude for working the metal after it starts to move and before it pulls apart. Depending on the mill characteristics of the metal, its yield strength and tensile strength may approach each other as it is being formed. Thus the working range is narrowed, and further working without fracture is impossible until annealed.

Interstage annealing is to be avoided where possible by a switch in the metal under first consideration, or by a switch in process. If annealing is inevitable it should be done properly.

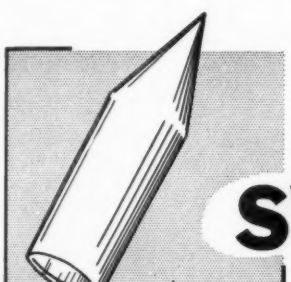
Someone once said that the batch-type annealing furnace and the old "jobs" found in many small shops cause more trouble than all other furnaces put together. Their control, which is a very important factor, is difficult.

Annealing temperatures should be closely controlled and the specified length of annealing time adhered to. If a metal's oxidation is undesirable, a protective controlled atmosphere should be used. Since your metal supplier knows that you can ruin metal by improper annealing, he will be happy to specify annealing temperatures and time specifications.

Where deep drawing is to be used for parts with tolerances that are exceptionally "fussy", as well as the specification of a low micro-finish, it might be well to consider an "ironing" operation in the processing. Deep drawing stresses metal under tensile loading beyond its elastic limit, but not beyond its ultimate strength. The compressive stresses will tend to wrinkle or buckle the blank or slug. These can be eliminated if sufficient "ironing" can be effected between the punch and die. Ironing requires careful adjustment of speed and pressure so that the bottom of the part is not punched out before the drawing is complete. "Ironing" as a specific operation is used where wall thickness and uniformity are to be improved and wall tapers minimized. Severe reduction is not expected with this operation. The punch pressures required to redraw (ironing) a cup between a punch and die where the cup interferes by 0.002" is considerably less than that required when the interference is 0.010". If high punch pressures are needed, then the cup bottom will be affected by thinning at the corners.

Concentricity of ID to OD is more often than not a part requirement. To obtain this, we suggest that you check your press as well as the punch and die relationship to the press. Ram play should be held to a minimum. The die should be well constructed having sufficient "beef" to withstand vectored pressures which might cause deflection. Also, the die should be level as it "sets" in the press. The punch should be square within itself, and it must also be rigid and properly attached to the ram.

As in many other metal forming operations, deep drawing for unusual untried jobs employs considerable trial and error. Experience is a tremendous aid in approximating the number of draws necessary. The design of the die, the press on which the job can be performed, etc. are important, but actual experimentation is usually the determinate.



SWAGING

Pointing or permanent assembly possible " . . . where uniform production and continuous accuracy are at a premium . . . ."

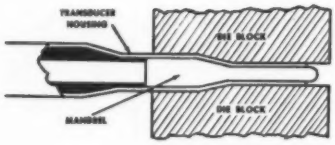
FOR MANY YEARS swaging had been used for pointing tubes or bar stock, prior to a drawing operation. Today, a wider understanding has been developed and swaging is recognized as a basic precision production method. Standard machines are capable of handling tube sizes up to 6" dia and solids up to 4" dia.

Skilled operators are not a must for swaging, as it is usually just a matter of feeding a piece into the die until it is reduced and hits a stop. In the case of automatic machines, all that is necessary is the filling of a rack or feed trough.

Hot swaging or cold swaging can be done on the same machine, although swaging "cold" is the most prevalent due to the advantages therein (please refer to the metallurgy section of this report).

In this process shaping is by displacement of the metal rather than by cutting it. Thus, there is an improved grain structure resulting in a higher tensile strength, a fine finish often comparable to a burnished finish, and very little scrap.

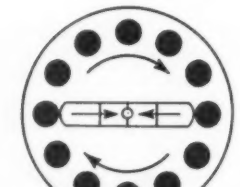
Swaging is also advantageous for much assembly work. Hardly any assembly operations, within the class of work shown, can be done by operations other than swaging with as much ease and economy. Few of us are surprised at the tenacity with which one piece will hold to another when they have been shrunk together, this is much like that which takes place when two parts are swaged together, only more so, due to the hammering which drives the two metals into the minute openings of each other's surfaces. The time saved is most obvious. There can be little argument that peening, crimping, brazing, pinning, or shrinking can be done as fast, or economically.



CONTROLLING ID WITH MANDREL

Swaging is also a ready "teammate" where uniform production and continuous accuracy are at a premium, as properly made dies will give almost unlimited production without size change.

Processing by swaging is accomplished by a series of rapid blows. The work is done by a multiplicity of minute blows rather than by a few severe ones. Swaging in its true sense is hammering to shape, and modern swaging machines accomplish this by split die construction



DEMONSTRATES ROTARY SWAGING PRINCIPLE

where opposing dies strike the part simultaneously as they rotate. The dies are forced together between rollers arranged in a circle (see diagram). As the dies rotate, they are forced away from the work by centrifugal force and are then driven against the work as the dies pass between two diametrically opposed rollers. In instances where four dies are used, all four move in together. As the dies separate, the constant endwise pressure (manual or mechanical) on the work feeds it inward a little each time until reduction is complete.

Although swaging machines, as such, can be valuable additions to any concern's capital equipment, and although the cost of such a machine is modest by comparison, the work to be done in this area may not always justify their purchase. If you decide not to buy a swaging machine then you have three alternatives for producing the part under consideration: 1) change the fabrication method to a chip forming method, such as turning; 2) "farming out" this phase of your production; 3) devise a method for swaging on your own equipment.

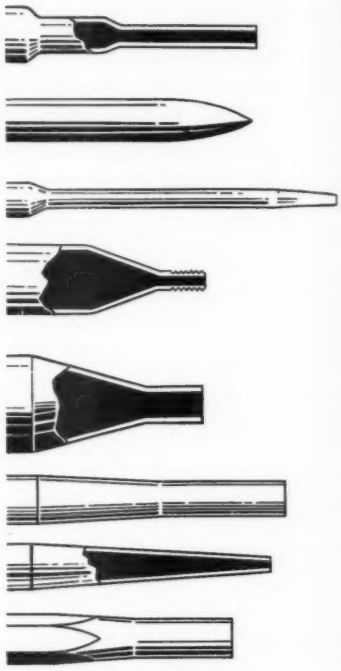
The chances are slim that you will be able to reconcile your processing or budget to a chip forming process once it has been established that the part should be swaged — there is just no comparison in time or material saving potential.

The second alternative, that of "farming out" is probably your best bet. However, to do this it must be established whether or not the cost of dies is warranted, as they usually are to be paid for by you and used by your jobber for you. If you can't see your way clear for this or machining, perhaps you can do the swaging job yourself by tooling-up one of your conventional machines.

Tooling procedure would be something like this: bore a tapered hole having the same taper as the part in an appropriate piece of high chrome steel as shown in the illustration, then slot the bore with three grooves.[1] Note that the intersection of the grooves and the tapered surface has been worked to a slight radius, and that there is a blended relief of several thousandths away from this radius worked into the tapered surface of the die. Actually it is these radiused edges of the grooves that will wipe the metal to smaller and smaller diameters as it is forced into the die. All work on the cavity should be machined to within lapping or stoning dimensions before heat treating to 62+ Rockwell C. The degree of surface finish of the die depends somewhat on the finish you expect on the workpiece and its tolerance. The finish must be good enough to prevent a cutting, scraping, or galling action which would cause tearing of the workpiece surface.

As the workpiece is forced into the die from a special holder in the tailstock, the die's high ridges wipe the metal that has flowed into the grooves to a new position, thus reducing the diameter.

Actually the above substitute swaging method is more like spinning in reverse than swaging. Due to the wiping[2] of the metal to a smaller diameter.



Examples of Shaping By Swaging

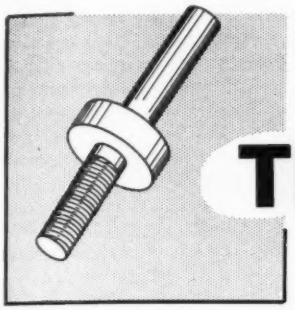
IN CONVENTIONAL SWAGING, wall thicknesses can be controlled by varying of the thrust pressure on the workpiece and the position of the stop. The use of mandrels also helps in this respect. This affords the necessary thickness in certain areas for threading for added strength.

Aluminum parts can be easily reduced 50%, and in some instances even a higher reduction without annealing is possible. Other metals do not enjoy such reduction without anneals, but even with annealing, unit prices are low in comparison to other forming procedures.

Other Examples of Swaging

A seldom thought of but interesting advantage of swaging is the possibility of keeping stock inventory low. Stocking one size tubing or bar for use in swaging several sizes in one die is often done. That is, the lead-in surface of a die can be as large as is necessary or practical to accommodate a variety of sizes of stock and finish pieces having similar end shapes. A group of products does not always fall within a die size, but when they do, the stop adjustment may be all that is necessary to change from one size to another.

[1]It may be found that more grooves are desirable if the production rate is high or the part inordinately large.
[2]Spinning is the shearing of metal over a rotating form either by a polished blunt tool or a roller. Here the point of contact of the tool and the spinning work is the only point of shear.



THREAD ROLLING

"With the trend toward automatic assembly . . . manufacturers are turning to thread rolling for production uniformity . . . ."

WE THINK A GREAT DEAL of our government, and in spite of a gripe here and there, we feel protected. By the same token, there is a comfort which comes with the use of a product or practice which has been accepted by "Uncle Sam." So it is with thread rolling in preference to thread cutting. In most instances where quality threads count, rolled threads are specified for government equipment.

Thread rolling is a forging process that forms threads by the displacement of metal under compression. Since fibers are not cut, and grain refinement and compacting take place, a strong[1] thread results. Threads are also superior from the standpoint of form, lead, and finish, and their use is preferred where they will be subject to severe tensile and fatigue stresses.

Part of the reason that rolled threads withstand fatigue stress is the fine surface finish produced in this manner. The burnishing action of the roll dies, as they displace metal, produces a surface free from marks or flaws of any serious nature which could be potential points of failure.

With the trend toward automatic assembly well underway, more and more manufacturers are turning to thread rolling for production uniformity, upon which automatic handling equipment depends for its performance.

"No waste" on high production operations is of great importance to Industry, and to this is added the

ON 'AUTOMATICS'

THREAD ROLLING ON AUTOMATIC screw machines is generally performed by two thread rolls, one on top of the workpiece and one on the bottom, which are advanced to the workpiece from the side and then are fed to the center thus producing rolled threads. This method is very advantageous when rolling threads behind shoulders. Another type of attachment rolls threads from the end of the workpiece and is advantageous when a long thread is to be produced. Two or three rolls are used.

The preparation of the blank for rolling is generally accomplished by shaving or skiving. It is very important that the blank diameter be round, straight, and uniform in size. It is therefore advisable to use a well designed shave tool holder. To assure uniformity when rolling threads on most ferrous metals and stainless steels, it is advisable to use carbide shaving tools to prepare these metals since they do not wear fast.

When setting the shave tool, it is advisable to shave a diameter which when rolled will produce a thread with the proper pitch diameter and a major diameter that is not quite rolled full. Once the pitch diameter is correct and there is no mis-match in the rolls, then the major diameter can be controlled by the shaved size of the blank. The ideal rolled condition is reached when there is a faint line at the crest of the thread detectable with a magnifying glass. When this thread condition is arrived at, it is important to **maintain** the shaved diameter used for a perfect thread and for good roll life. If the shaved diameter is allowed to increase, roll crowding will result and the rolls will break down. If the shaved diameter decreases in size, the rolled thread will be undersize on its major diameter.

To prepare a blank for end thread rolling, the same conditions must be met. The blank must be straight, round, and uniform in size. Because this type of thread is longer, the blank is best prepared by box milling, roller twining, or hollow milling.

Care must be exercised when working with materials that work harden. If too much roller pressure is used, the blank will have a higher Rockwell reading and thread roll life will be short.

INTERNAL THREADING

ALONG WITH THE "COLD" FORMING of **external** threads, new developments in taps permit many of the same advantages in the production of **internal** threads. The advantages are derived from moving rather than removing metal.

Besley-Welles "X-Press" taps are at present being used for forming threads in a pre-drilled hole in ductile non-ferrous metals. Sizes from 0 to 80 NF and ¼ to 28 NF are presently available, and testimonials back up their claims to stronger threads with a substantial saving in tool cost. Without chips to load the tap, a greater thread accuracy is possible and tap breakage is held to a minimum.

Actually the tap is very similar to the male fastener which will occupy the hole. It is easy to understand that breakage would be more difficult since flutes are not present to diminish the cross-section of the tap. One testimonial stated that their tap breakage had been reduced 75%, and in this instance the holes to be tapped were cored holes in an aluminum die casting.

We can also see a fringe benefit (possibly much more) in the fact that larger drill sizes are used, for a comparable thread size, than in conventional tapping. Like thread rolling, in that the starting diameter is the thread pitch diameter, this extra "beef"—especially in small drills—is insurance against breakage.

The holding power of threads made in this manner has been known to be as much as 300% greater than those cut by conventional tapping. Although the thread production is sometimes lower (approximately 20%), this is of small consideration in respect to advantages gained.

economy of "no tool point maintenance."

Another advantage of "cold forging" threads on the ends of rods, for instance, is the possibility of saving material to the extent of the thread depth for the length of the rod. This is true since the thread rolled portion to start is a diameter equal to the pitch diameter of the thread, whereas, in machining (cutting) a thread the rod diameter must be equal to the major diameter of the thread.

From the standpoint of the elimination of fatigue focal points, the burnishing involved makes it impossible for milling, chasing, or grinding threads to compare with rolling. Although ground finishes have low rms values of 15 to 30, the burnished finish of rolled threads produces a micro-finish as low as 4 rms. Milling and chasing follow grinding in the progression toward rougher surfaces.

The concentrated compressions of fibers left at the root of a rolled thread indicates high compressive stress in the area where tensile stress is most apt to occur. Before tensile stress can be present to cause failure, the compressive stress must be surmounted, so the possibility of failure from fatigue is in many cases reduced by as much as 75%.

There are several types of thread rolling machines all effecting primarily the same result — threads produced cold and each having its place in our production picture. Machines can be equipped to roll threads on both ends of the rod at the same time. Right or left hand threads can usually be handled, and continuous rolling can be done as on threaded stock.

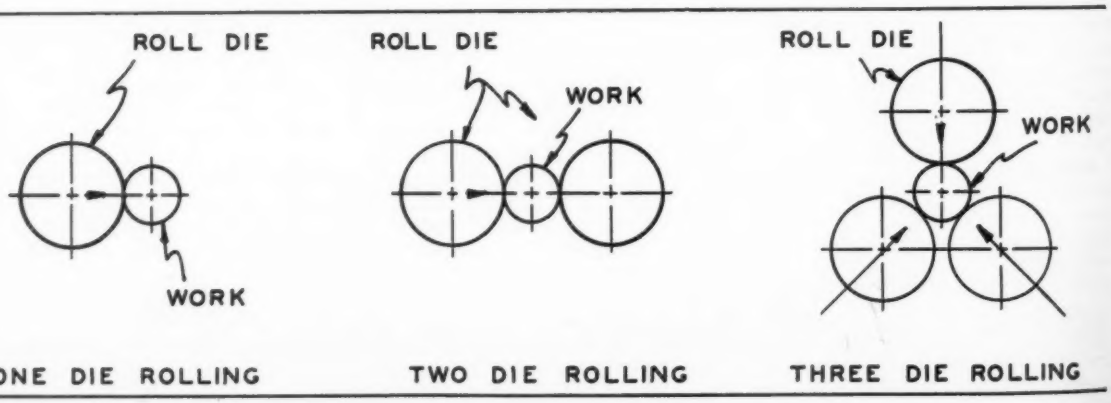
For general-purpose thread rolling a vertical machine of the three-die type is often preferred. Being vertical, many parts can be allowed to locate themselves by gravity against the stop. Horizontal machines of an in-feed or through-feed variety are usually recommended for heavier work.

Rolls are furnished with either helix-cut grooves or straight grooves. Those with straight grooves simulate a helix when tilted on their axes, and with this setup a variety of pitch diameters can be rolled with the same set of rolls. Rolls without a helix are used for threading by the through-feed method whereby the workpiece moves one thread axially per each revolution.

Although both in-feed work and through-feed work impart the same advantages to the thread, greater thread accuracy is realized from in-feeding.[2] However, if your needs are for a variety of sizes using the same pitch, a machine equipped to operate with straight grooves will prove fast and economical.

THREAD ROLLING DIES are either flat as used in reciprocating machines, or round[3] with the thread form on their periphery, and are used in all types of machines and attachments.

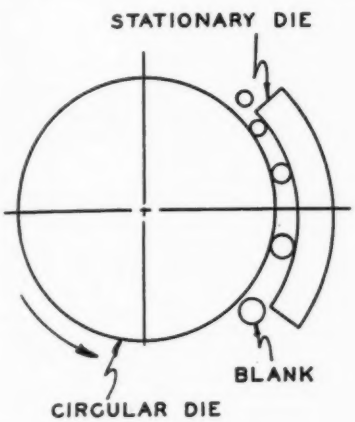
In the reciprocating machine, one flat die is stationary while the other moves over it at a predetermined height (to establish pitch diameter) with the blank rolled between them. The blank is fed into one end at the start of the stroke and rolled out the other with the thread impression



ONE DIE ROLLING TWO DIE ROLLING THREE DIE ROLLING

having been forged into its surface. Standard reciprocating machines roll up to 1" dia threads and are best known for their versatility of thread form. Some threads, like gimlet and drivenail threads, are more easily produced with a flat forming surface than with a cylindrical surface. Unlike the cylindrical die machines' there is no axial movement of the blank in forming the thread.

Planetary rotary machines have one central die wheel on a fixed axis and a concave segment die arranged in the proper relation so that blanks can be rolled between them. The segment die is not arranged concentric with the cylindrical die so that



PLANETARY ROLLING

the blank may enter the larger gap at one end of the segment and leave at the other end, formed. This type of machine is fast in that several parts may be forming continually within the segment length.

Machines using cylindrical dies are of the two-die or three-die type, depending on the application. The two-die cylindrical machine is **usually** used for in-feeding or plunge rolling where the work does not move axially (although axial through-feeding is possible with the proper rolls). In this machine short length threads or threads behind shoulders or obstructions are rolled. A work rest is used to establish the theoretic PD of the workpiece in coincidence with the PD of the rolls. Here one die "forges" the workpiece into the opposing die at a predetermined feed rate.

Where three dies are used in a thread roll machine, the PD is determined by three equally spaced dies using helix thread rolls which plunge into a setting. An end stop can be used for positioning the threads axially. Pieces may be through-fed (straight thread rolls) that will effect a thread along the entire length.

On standard thread rolling machines of either the two-die or three-die type, setup time has been minimized appreciably. The setup is much faster than that required with an attachment used on an "automatic." However, if precision threads are expected and shaving is necessary, time can be saved and an operation eliminated by this being done in one of the stations on the "automatic." If threading on a thread rolling machine, this sizing and finishing operation must be done on separate equipment.[5] Where finish part tolerances permit, it is common to use mill stock drawn to commercial tolerances. A total tolerance of 0.001" on rod or wire diameters will allow adjusting the PD of the rolls to avoid crowding or over-rolling and still permit rolling a part within tolerance.

One-roll threading in an "automatic" is possible for short threads or where the thread is close to the chuck. However, unless the workpiece is of a soft material **and** the threads are close to the chucking device, rolling with one roll is not practical. By using one-roll threading, these difficulties can plague you: the thread PD may not be uniform for the entire length of thread, roll die life may be short, chipping of the rolls may occur, and the spindle bearing wear rate may be high. It is more practical to straddle the part with two dies.

There are a number of thread rolling attachments available for automatics and turret lathes which produce accurate threads quickly. The only drawback is setup time, although the problem has been reduced considerably by design improvements.

PREPARING THE BLANK

IN THE PREPARATION OF BLANKS for very accurate threads, centerless grinding is necessary if threads are to be rolled on a thread rolling machine. Where the parts production comes off an "automatic", a shaving tool usually accompanies the thread roll attachment for holding the pitch diameter to close tolerances.

Close tolerances can increase roller die life. This is easy to see when you consider the crowding which takes place when rolls are set for a pitch diameter and the blank's pitch diameter is greater. Even a few tenths oversize sets up tremendous pressures detrimental to die life.

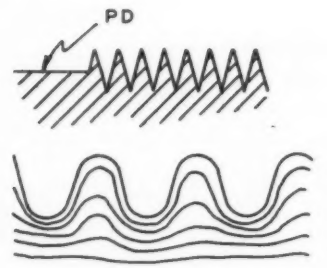
Die failure from chipping of the thread crest can be allayed if the blanks to be threaded are chamfered on the end. A 60° included angle chamfer is usual, with its end diameter smaller than the minor diameter of the thread.

Changing the blank diameter to or below that of the pitch diameter is most important when the mill stock is tending toward the high side of its tolerance. In threading softer materials an endwise growth takes place which eases the pressure on the rolls—and the tolerance requirements. In some cases it may be necessary to compensate for this eventuality by purposely creating an oversize diameter.

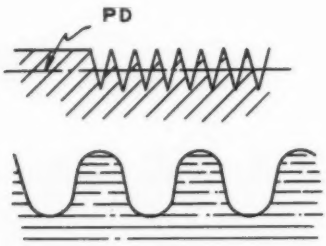
In the preparation of blanks by heading, it is general practice that the shank diameter be held to a Class 2 Free Fit tolerance. Actually, these tolerances are borrowed, as they are used to designate a thread fit. For example, if a ½-13 thread is to be rolled on a previously cold headed blank, the shank diameter would be held to 0.4435" dia plus a die makers allowance of about 0.0004". This, in other words, would be the diameter of the shank, as it is first headed. As the heading die wears, the diameter of the headed part will approach 0.4485" dia (maximum pitch diameter for a ½-13 thread). When 0.4485" diameter blanks come from the header (or before, if wear is uneven) it is time to consider changing dies.

In heading and preparing a blank for a cut thread, a wire of the major diameter of the thread will be used.

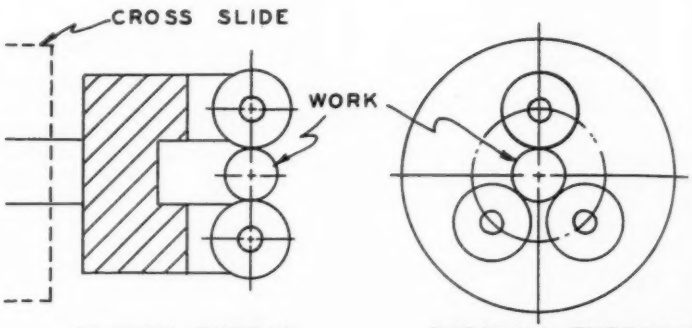
Threads of a closer fit can be rolled — such as Class 3 Medium Fit or even Class 4 Close Fit, but die life is comparatively shorter. That is, the die wear range is smaller due to a narrower tolerance range.



ROLLED THREAD
SHOWING STRENGTHENING
BY FIBER FLOW



CUT THREAD
SHOWING WEAKER CUT FIBERS



PLUNGE THREAD
SHORT THREADS

THROUGH THREADING
LONG THREADS

THREAD ROLLING ATTACHMENTS

It is usually axiomatic that the greatest savings percentagewise can be realized by long production runs which might indicate the purchase of a thread rolling machine. The use of thread rolling **can** show similar economies in lower production runs on screw machines or turret lathes depending on the part and the processing necessary.

IN GENERAL THEN, it can be stated that the planetary thread rolling machine is used for the high production of threads up to ¾" dia. Up to 1500 ppm in the ⅛" dia size, on down to 200 ppm in the ¾" dia size can be realized. The reciprocating machine will roll threads up to 2" dia which the planetary cannot, but within its range comparable diameters would be rolled three times faster in a planetary than in a reciprocating machine. The more precise, but slower, cylindrical machine will roll threads at speeds approximately ½ that of a reciprocating machine and in sizes up to 4" dia. Speeds can be only generally stated as the type of thread, the material and tolerances all effect production and the machine to be used.

This thread rolling business is no small matter, as approximately ⅔ of our threads are currently produced by rolling methods in preference to cutting.

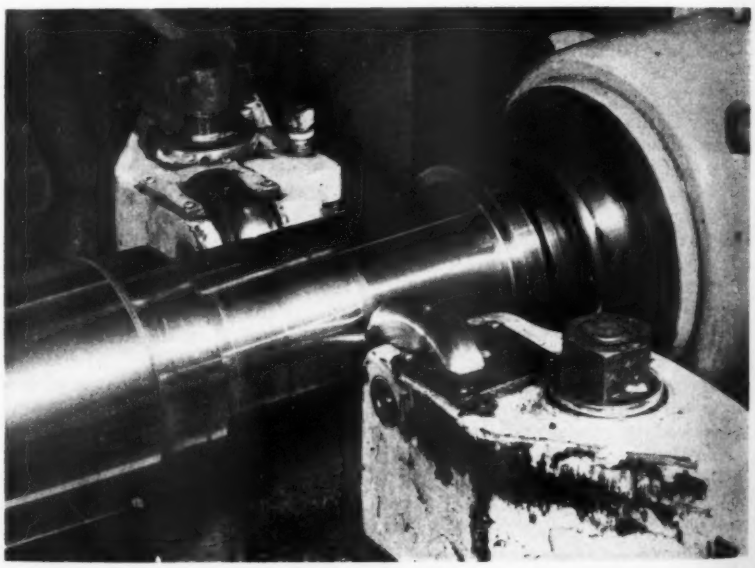
[1]From 15% to 20% stronger than a cut thread.
[2]Sometimes called plunge-rolling.
[3]Segment die used with round die in a "planetary" is an exception.
[4]Neither is there axial movement of the part when producing a thread with the two-die attachment used in an "automatic." The three-die open type attachment, however, can be arranged for through threading. Here, the attachment will move over the work for as long a distance as the machine can accommodate.
[5]Centerless grinding is often used.

BURNISHING

Burnishing has always implied a surface finishing process that approached sizing. It has been successfully adapted to broaches and dies, and is connected with tumbling — a smoothing process where a workpiece is placed in a rotating wood lined enclosure with some steel balls and soapy water.

At the present time burnishing is also thought of as a non metal-removing polishing method that involves rolling a semi-rough workpiece against a very smooth hardened steel or carbide roller called a "burnisher."

Not only is the surface worked to a surface finish conforming to that of the burnisher, but the pressure and cold rolling increases the surface hardness by compressing and compacting the grain structure of the metal.



Cincinnati Combines Quality Control and Production Control

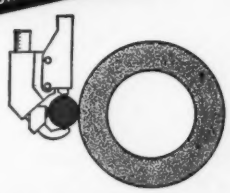
for Your Precision Centertype Grinding

CINCINNATI FILMATIC
6"R x 18"
Plain Hydraulic Grinding Machine
Equipped with Quality Control and Production Control

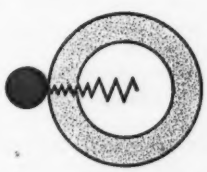
FILMATIC Grinding Wheel Spindle Bearings and Grinding Wheel Balancing are standard equipment. (FILMATIC principle illustrated above.) These two cost-reducing features alone are reason enough to choose CINCINNATI.

Every shop wants closer control of quality and production. It's especially desirable for final operations, when cost per unit nears its maximum. In the field of precision centertype grinding on 6" to 14" machines, Cincinnati's standard and extra features combine quality control and production control into a unified, automatic function of the machine.

The cost-control features illustrated at the right, and many others are outlined in two attractive catalogs: No. G-660-1 for the CINCINNATI® FILMATIC 6"R and 10"L Plain Hydraulic Grinding Machines. No. G-661 for the 10"R and 14"L Machines. Write for copies, or look in Sweet's for brief specifications.



Automatic Air-Electric Gage Sizing (extra) includes an exclusive CINCINNATI advantage . . . cycle time stabilizer for wheel wear and truing.



Gap Eliminator . . . greatly reduces time spent in "cutting air" during automatic infeed grinding operations. (extra)

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

Members of this family group of CINCINNATI FILMATIC Plain Hydraulic Grinders are:

Size	Between-Center Lengths	Catalog
6"R, 10"L	18" and 30"	G-660-1
10"R, 14"L	18", 36", 48" 72" and 96"	G-661

CINCINNATI FILMATIC

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 113

ROLLER BURNISHING

Roller burnishing is a fast internal surface finishing method for all metals up to a maximum hardness of 35-40 Rockwell C. Its simplicity of operation requires no special skills, and it can be set up in conventional shop machines.

The tool, rotating at standard speeds, is brought to the face of the work where it is self-fed through the workpiece. One pass completes the operation. Standard mandrel shanks, micrometer adjustment for diameter, collars for blind-end holes, and tool release mechanisms are included.

A very smooth surface prior to roller burnishing is not a requirement, but a "good bore" is desirable. Boring tool "peak and valley" patterns are advantageous, as one is displaced into the other by the rolling action. Roller burnishing will not correct an out-of-round condition or gouges and tears caused by reaming, and a wavy condition in the bore may result when the radial force is relieved by variations in the wall thickness of the workpiece.

Metal is not removed during the process, and surface hardness of the ID of the workpiece is increased by the cold working. Grain structure is condensed and compacted, and sponginess is removed from the worked surface of softer material. Surface finish ranges from 1 to 5 micro-inches rms for steel, 4 to 8 for bronze and aluminum, and 10 to 15 for cast iron.

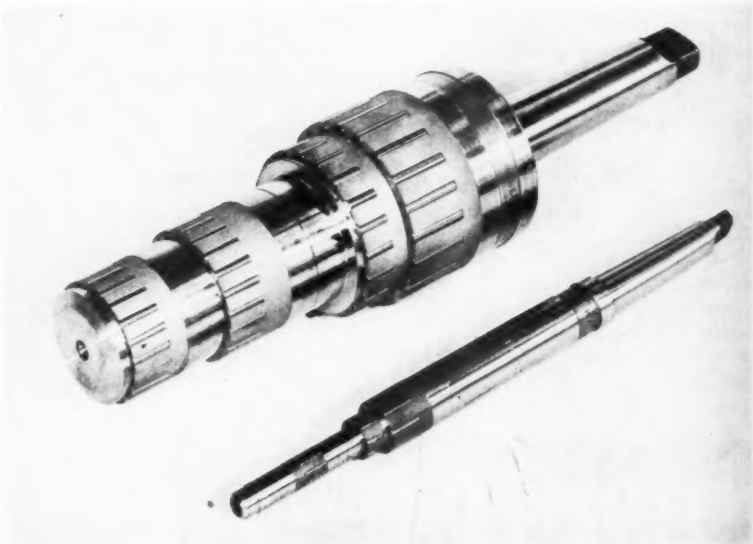
BEARINGIZING

A fast internal and external surface burnishing and sizing process called Bearingizing is identified by a rapid peening action of cam operated rollers. No special skills or special machines are needed for its use.

The workpiece surface to be burnished and sized should have uniform tool markings and be free from deep tears or gouges. The rotating Bearingizing tool is fed quickly through the workpiece using light pressure, and one pass completes the operation. Holes 4" long have been sized and finished in less than two seconds. Metal is not removed but is densified by the cold working action of the peening rollers. Pre-burnishing or a second pass is not recommended as the surface metal structure may be crushed and flaking result.

Many controlling factors contribute to the final surface finish—metal used, grain size, grain flow ability, porosity, preparation of surface, wall support, and amount of change in size of worked surface.

A wide variety of materials show work hardened surface finishes of 1 to 8 micro-inches rms with a very high degree of accuracy.



Announcing

the New!

B900 Series K. O. LEE GRINDERS

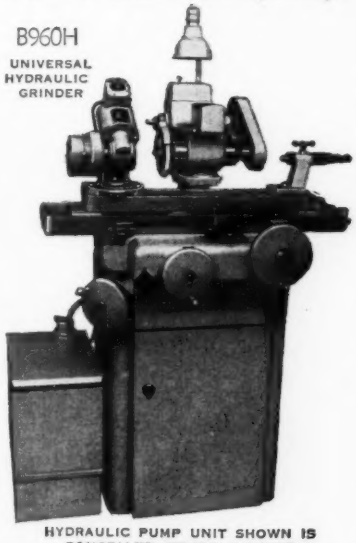
Model B960
Universal Grinder
SHOWN WITH B943 MOTOR-DRIVEN WORK HEAD AVAILABLE AT EXTRA COST

The new Lee grinders have improved accuracy standards, greater capacities, 25% heavier construction, V-type Saddle, larger table ways, improved lubrication system giving longer life, and many refinements for easy operation. New engineering features simplify and minimize time in making setups for almost every operation.

Available Models

B900 Tool & Cutter Grinder
B900X Basic Tool Grinder
B960 Universal Tool Grinder

K. O. Lee Company Offers a Complete Line of Grinder Fixtures



B960H
UNIVERSAL HYDRAULIC GRINDER

HYDRAULIC PUMP UNIT SHOWN IS CONCEALED INSIDE CABINET

The K. O. Lee Company makes available a large selection of fixtures adaptable to the B900 series grinders. Partial list includes: Motor Driven Work Heads, Tap Grinding Fixtures, Tilt Table Attachments for forming and sharpening cemented carbide tools, High Speed Grinding Attachment, Radial Grinding Fixtures, Universal Work Holding Fixtures, Sensitive Work Heads, Diamond Dressers, and Cutter and Hob Grinding Arbors.

HYDRAULIC POWER UNIT

For Table Traverse Available on all
LEE B900 SERIES GRINDERS

Hydraulic Pump Unit Shown Is Concealed In Base Cabinet

CLIP AD TO LETTERHEAD
AND SEND FOR COMPLETE LITERATURE

K. O. LEE COMPANY, ABERDEEN, SO. DAKOTA

"The new B900 series K. O. Lee grinders will be on display at the National Metal Exposition, Chicago, Booth 1397, November 4-8, 1957."

CIRCLE INFORM-A-GRAM KEY NO. 115

BALLIZING

This form of burnishing provides fast and precision hole sizing and finishing. The basic setup is simple, and unskilled labor can be utilized with minimum supervision.

A tungsten carbide ball (89-91 Rockwell A) of a specified interference fit is placed in the hole of the workpiece, and the worker uses a press to force it through. Scrap is produced only by gross carelessness as the ball is self-centering, does not need to be guided, cannot make an oversize hole, and sudden changes in adjustment are impossible.

The process does not remove metal but compresses and smooths a thin layer of the ID metal by plastic flow which tends to refine the surface grain structure and produce a layer of denser material. Size and sphericity are usually held within .000025", and surface finish of 1 micro-inch rms or less can be provided. The surface finish of the ball predetermines the work finish.

The workpiece must be of ductile material and free from variance in hardness, porosity, sponginess, or casting hardspots. Hardness for high carbon or alloy steels must fall below a 40 Rockwell C rating.

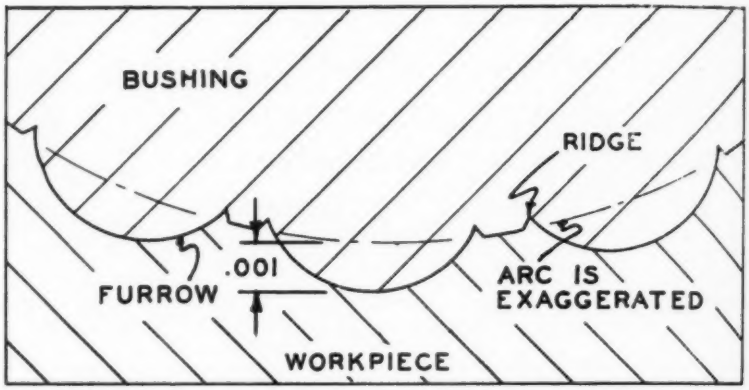
Fixtures have been devised that return the long life tungsten carbide balls into position automatically, for high production setups.

BALL-BROACHING

Ball-broaching provides a fast means of securing bushings in gears or other parts that eliminates the necessity of keys, pins, or splines.

A tool with a row of free rotating hardened steel balls around its OD is pressed through a workpiece. The balls produce furrows in the worked surface through plastic flow of the metal. The furrows are about .0010" deep and ridges are forced up about .0004". There is no cutting or shearing, and the cold working increases surface hardness.

The bushing is pressed into the broached bore and the cold worked ridges cause the softer material of the bushing to flow into the furrows. A very rigid bond results that prevents radial movement. The process also prevents axial movement of the assembled parts.



BALL-BROACHING

High carbon chrome steel balls of 63 to 66 Rockwell C have broached 1000 to 2000 workpieces of 45 Rockwell C before ball replacement has been necessary. Harder surfaces have been worked by using cemented tungsten-carbide balls.

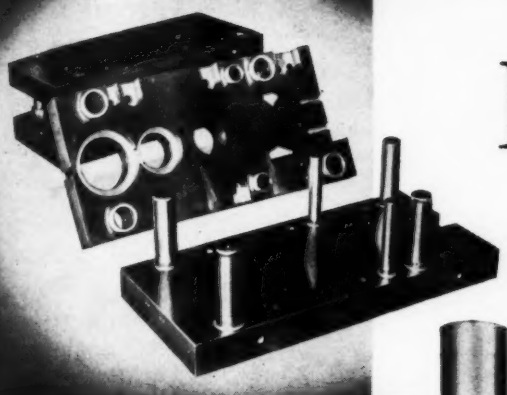
The process is adaptable to external as well as internal broaching, and the surface has been re-used by replacement bushings up to 5 times.

TURKS HEAD

The turks head process provides high and quality production of square, rectangular, or special shapes for ferrous and nonferrous wire or rod. The turks head, as such, is actually a component of a wire shaping mill.

Operating on the rolling mill principle this multi-roll, adjustable, draw die imparts an improved surface finish, accurate size, and the benefits of cold working to the surface grain structure of the material. The rolls usually are integrated, two vertical and two horizontal, and can be actuated by either pull-through or power driven procedures.

The higher the quality of the stock used, the better the finished product. Accessories such as a straightening device and a stock entry guide can be supplied for more efficiency of operation. Commercially sharp corners and extreme accuracy requires two passes through the turks head, however, two heads in tandem produce excellent results. Speeds of up to 500 fpm are reported.



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CIRCLE INFORM-A-GRAM KEY NO. 117

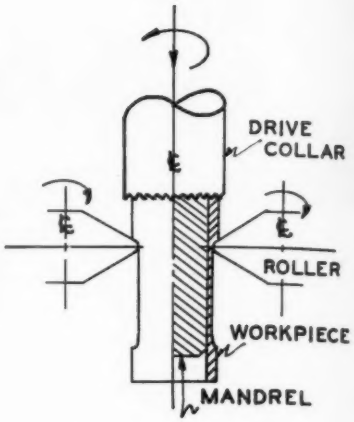
ROLLED EXTRUSION

Rolled extrusion or "Uniskan" (single-pass extrusion) facilitates the manufacture of fragile, cylindrical items that have a material thickness of .001" to .020". Great reductions in work thickness are possible, and usefulness is evident on work where length to diameter ratios are greater than 4 to 1.

A small cylindrical workpiece is slipped over a mandrel and is butted against a toothed drive collar. This assembly is then rotated in a drill press. Three rollers (one adjustable) on a self-centering frame are fed into the workpiece; the amount of feed determining the thickness of the extruded part. Axial force is applied by means of the drive collar that backs up the workpiece, and the metal is forced through the rollers forming a thin cylinder around the mandrel. Extruded length is not restricted, as the metal is free to extend off the end of the mandrel.

By providing the mandrel with the necessary grooves a variety of grid type extrusions can be made.

A cup type workpiece can be extruded by placing it over the end of the mandrel and substituting a pressure pad against its bottom in place of the drive collar. With this setup, however, the extruded length is predetermined by the length of the mandrel. Extruded materials have ranged from soft copper to molybdenum.



ROLLED EXTRUSION

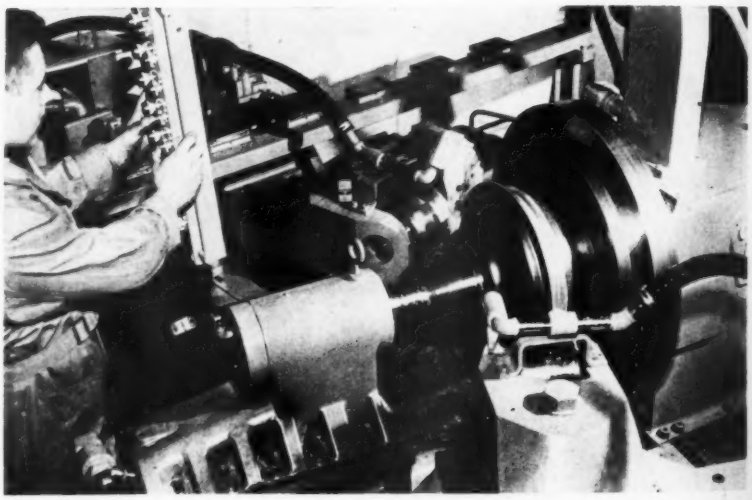
SPINNING

The process of spinning metal finds direct application in the manufacturing of hollow cones, spheres, or cylinders. Other benefits include good internal and external finishes, low tooling cost, the ability to vary wall thickness accurately, improvement in tensile strength and fatigue resistance through cold working, and saving of material by chipless machining.

The workpiece blank is spun by rollers or spinning tools over a wood, plastic, or metal mandrel that corresponds to the desired finished shape. It is accomplished on a machine that resembles a power lathe.

The two spinning methods in use are **shear** spinning or working toward the machine head stock and up the mandrel from flat or preformed blanks, and **roll** spinning or working away from the head stock and down the mandrel using cylindrical blanks. Reduction in wall thickness for roll spinning has reached 90% using a two-roller setup.

Nearly every type of metal can be cold spun, but some are more ductile. Certain aluminum alloys spin very easily, stainless steels are average, while molybdenum is very difficult. An answer to the tougher metals and to higher production has been found in the development of hydraulically operated machines (Hydrospin, Floturn, Flotrusion, and Mecatorn). Tool pressures in these machines can reach 400,000 psi, and only hexagonal crystal structured metals like titanium require heat with these high pressures.



It is interesting to note that the spinning of straight wall tubes (roll spinning) is very closely related to the rolled extrusion process. Blanks for spinning include mill-rolled sheet, plate stock, forgings, castings, and even welded forms. Under ideal conditions the ID and wall thickness can be held within ±0.002 and a surface finish of 32 to 63 rms can be accomplished due to the burnishing action of the tools.

this modern

CLEVELAND PRESS

embodies every essential feature for

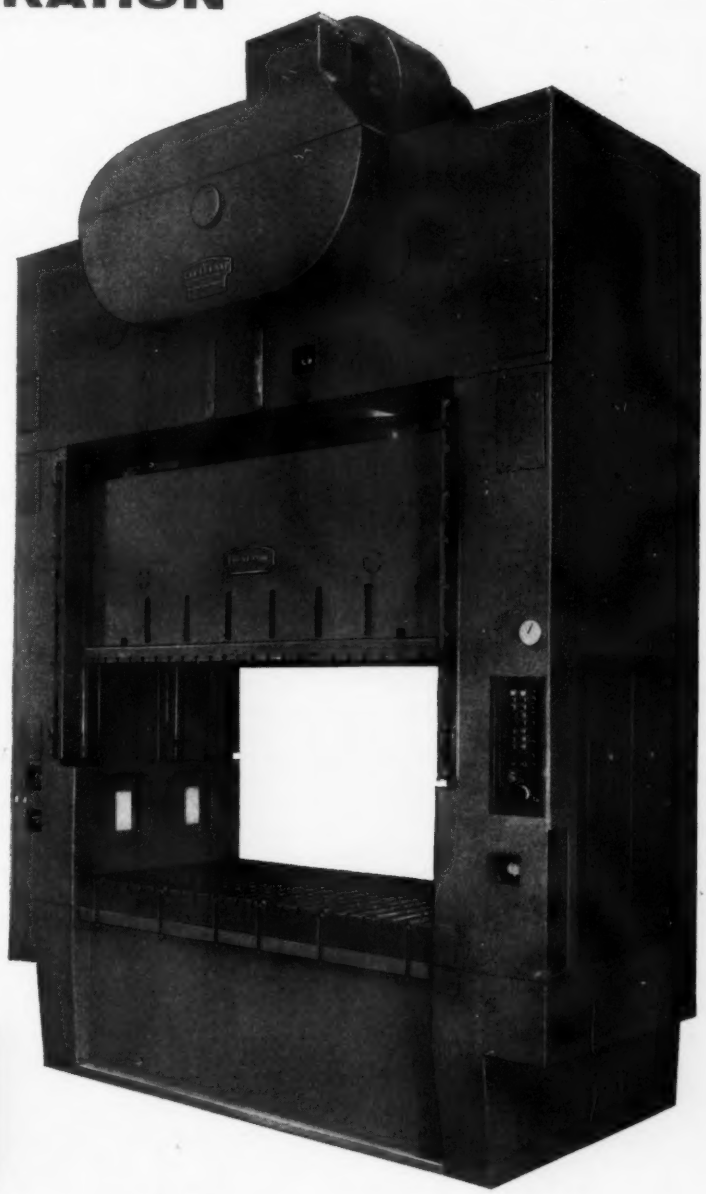
EFFICIENT OPERATION

Recently installed in the plant of a leading automotive manufacturer, this Cleveland Four Point Press is designed to produce several different types of automotive stampings.

Features on this press are:

- Electrically controlled air-operated Cleveland (patented) Drum Type Clutch with spring loaded brake
- Air counterbalanced slide
- Pneumatic cushion in the bed, with controls for separate operation
- Auxiliary air brake on flywheel
- Lighted die area
- Gears completely enclosed, spray lubricated
- Stroke indicator
- Built to JIC Standards

Cleveland Four Point Presses can be furnished in a wide range of sizes, with capacities to suit particular requirements by modifying the stroke, adjustment, bed and slide areas. All models have this in common — maximum accuracy and die life . . . minimum maintenance and per-part costs . . . that's why it pays you to look into the advantages Cleveland Presses offer.



500-ton capacity, 24″ stroke with 15″ adjustment; shut-height 61½″; slide and bed both 72″ x 144″.

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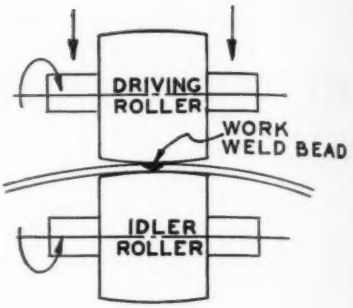
CIRCLE INFORM-A-GRAM KEY NO. 119

ROLL-PLANISHING

Roll-planishing is a fast and inexpensive process for flattening and improving the mechanical properties of weld beads. Simplicity of machine operation alleviates the need for special operator skills, and the process is limited only by the length and metallurgical properties of the workpiece, and the weld-joint configuration. The process was developed to increase speed and reduce the cost of hammer planishing.

The weld to be roll-planished is run between the driving and idler rollers of a machine with a heavy "C" type frame. Extremely high or low pressures are possible through a pneumatic system. A workable range of materials extends from titanium to aluminum with the softer metals being the harder to control.

The cross-sectional area of the weld is controlled before roll-planishing to prevent excessive distortion and to provide the desired surface. Improved surface grain structure and relief of shrinkage stress is provided by the cold working of the machine's rollers. Material can be heat treated before welding thus removing the risk of cracking the weld by post heat treatment procedures.



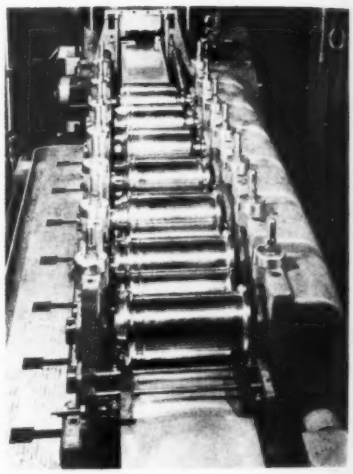
ROLL-PLANISH

ROLL-FORMING

Roll-forming is a process for rapid shaping of coiled flat strip metal that produces strong, light, and uniform sections of a high finish. The sections are adaptable to modern fabricating or shaping and are found in widely diversified fields such as automotive, buildings and furnishings, electrical, and toys. This author has counted over 75 applications for aluminum strip alone.

This method of cold forming is designed for low cost, mass production which has reached 30,000′ per machine per day with a two-man team. As the metal is formed continuously the section length is dependent only upon the length of the coil used. It is interesting to note that there could be a serious problem in over-production connected with roll-forming for literally miles of finished parts can be run off in an 8-hr day. The term finished is used advisedly as it is now an accepted technique to paint material before roll forming.

The material is passed through a series of tandem aligned rolls that progressively cold form the final shape. A tolerance of ±0.005″ can be held on standard sections. Slitting, combining, filling, trimming, perforating, wrapping, welding, coiling, and flying cut-off systems can be adapted as automatic parts of the process.



TUBE BENDING

Compression and elongation encountered during the bending of solid bar or tubing is very similar, however, the lack of wall support in the hollow tubing tends to cause flattening or wrinkling. Various bending procedures and types of equipment have been developed to overcome this tendency, and, as a result, the minimum radius of a bend for diversified material is totally dependent upon the equipment used.

Cold bending or coiling may be accomplished by three methods in five basic types of equipment. The three methods involve bending without a mandrel or filler material, bending with a mandrel, and bending with filler material.

The five basic types of equipment used are revolving dies (draw bending), stationary dies (compression bending), rolling, pressing (ram bending), and reeling (compression bending).

Short radius bends on light wall tubing are made possible by the use of a mandrel on the inside of the tube at the tangent point of bending and the outside supported by wiper and follower blocks. Mandrel position is critical as too far past the tangent line will cause a sharp rupture, and not far enough will result in excessive wrinkling of the tubing.

THE NEW **LEWIS** *Convertible*

AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINES WITH VARIABLE SPEED DRIVE AND DUAL-CENTER STRAIGHTENER ARBOR

Front View No. 2CV4 ... Capacity 1/16" to 1/4" diameter. (No. 2CV5 capacity 1/16" to 5/16" diameter.)

✻ The new Lewis No. 2CV series is equipped with our Dual-Center Rotary Straightener Arbor and can be quickly converted to handle shapes by installing our interchangeable Roll Straightener.

This convertible feature introduces a new flexibility in wire straightening and cutting operations . . . one machine can serve a double purpose in your plant. Higher production with greater accuracy is achieved through the use of a Variable Speed Drive which permits the correct feed speed (up to 200 FPM) for all requirements.

The outstanding feature of this series is the DUAL-CENTER STRAIGHTENER ARBOR (Pat. Pending) for round wire. This feature increases the range of the machine and makes it possible to precision straighten small diameters below the capacity of other machines.

Other models available to handle .012" to 1" diameter, as well as shapes.

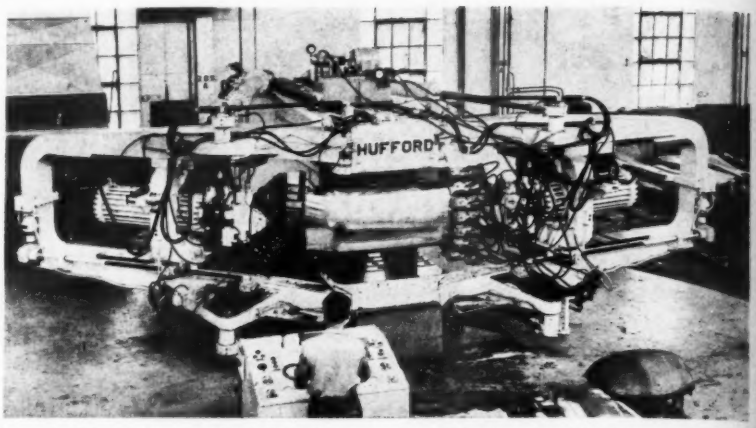
See No. 2CV4 and the sensational No. 4FH at the Lewis Booth No. 1418 at the Metal Show, Chicago, Nov. 4-8

THE LEWIS MACHINE COMPANY

3441 East 78th Street • Cleveland 27, Ohio • A Division of Curtis Mfg. Co.

STRETCH-WRAP FORMING

A wide range of forming and bending operations with titles like stretch forming, stretch wrap forming, or contour forming all involve the stretching of metal over a die. Although there are differences in method, the general procedure is to clamp the ends of a metal blank in hydraulically operated jaws, bring the material slightly beyond its yield point, and while it is in a plastic state form it over the die where it retains the shape of the die.



The types of stretching machines vary; however, the most accepted designs are: first, a vertical die or rotating arms type where the clamping jaws hydraulically pull the metal under tension around the die; second, the horizontal die or moving ram type that either holds the blank while the die is forced into it or hydraulically places the blank under tension and then forces the die into it; and third, the rotating die where the metal is wrapped around a turning die on a rotating table.

The finished piece has the advantages of work hardening through cold forming; a definite lack of springback; a reduction in set-up costs as there is only one die which may be made of hard wood, plastic, or concrete; no compression failures such as wrinkling or buckling; and no localized thinning of the material

SHOT PEENING

The process of shot peening produces its greatest benefits in two fields—cold working of surface metal and cleaning of work surfaces.

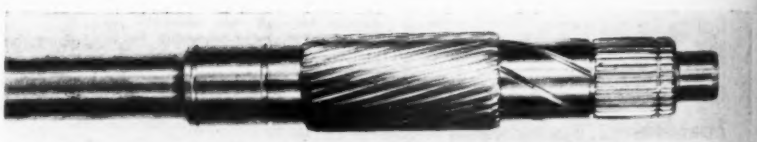
In addition to work hardening the surface, the plastic flow of the metal under the hammer-like blows of the shot causes a surface compressive stress. This stress is beneficial in increasing the fatigue life of cycle stressed parts, and also counteracts the tensile stresses set up under beam loading.

The surface, being the weakest point of a part structurally, represents an extremely critical fatigue potential. This is especially true at places termed "surface stress raisers." These can be punch or tool marks, keyways, holes, seams, corroded areas, or surface defects that might fail and initiate a crack. Shot peening definitely retards and has been known to stop the effects of surface stress raisers which make up about 90% of all fatigue failures.

There are two basic types of shot peening machines. In one a bladed wheel rotating at high speed slings the shot at the work. This type is generally best for large volume production in which the work is fed past the machine. In the other type the shot is forced at the work by pressurized air. This style is adaptable to short run or individual peening and can be directed at the work as required.

FORM AND SPLINE ROLLING

A definite part of high production today is the cold roll forming of ASA splines and serrations, SAE tapered serrations, and oil grooves. Present research may prove helical gear teeth another possibility for this process.

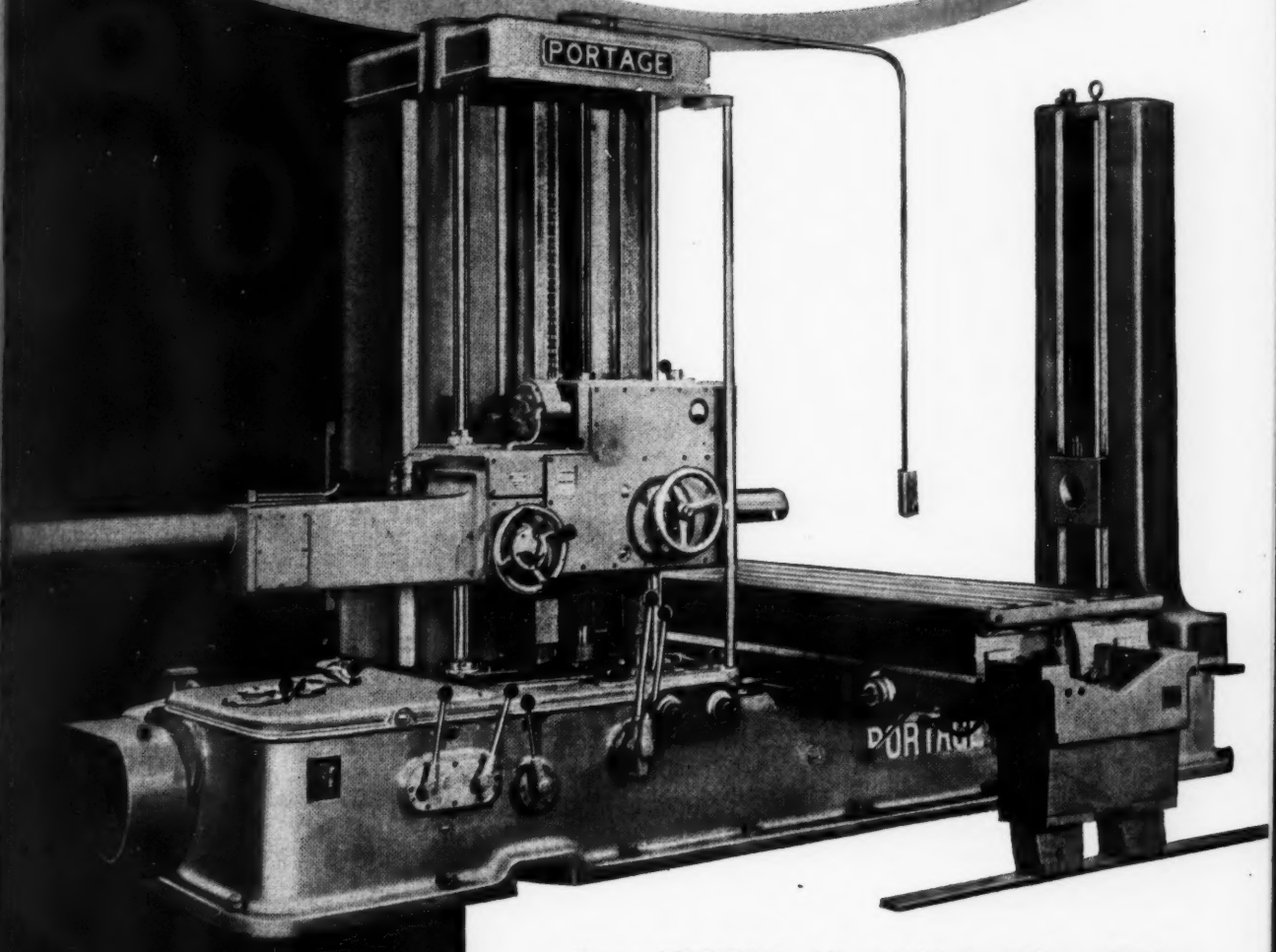


A comparison of this method with hobbing reveals some interesting data: In torsion tests rolled splines proved 10 to 20% stronger. The resulting surface finish was 3 to 6 micro-inches, rms, compared to the hobbed surface feed-marked 500 micro-inches, rms. The ability to roll form teeth up to a shoulder without damaging it, the lack of corner "dog ears", and the absence of "laps" at the top of the tooth structure are obvious advantages. Production speed of a 4-sec forming time to a triple head hobbing time of 1 min 50 sec, and a tool sharpening schedule of once per 200,000 parts for rolling to 200 parts for hobbing add to the advantages.

As with other cold forming processes, no metal is removed. The workpiece is placed between two oppositely moving forming racks of high-chrome steel that have the required shape accurately ground in them. The racks are made to just contact the workpiece at the start and, as they roll, press deeper until the required depth is attained.

PORTAGE *Announces...the*

NEW LOOK



The new PORTAGE No. 4 Horizontal Boring, Drilling and Milling Machine has a complete NEW LOOK. A heavier base, column, saddle and head are a few of the new features. The overall "beefed up" machine offers a wider range of versatility. NOW... you can handle the larger work ... with the smallest possible capital investment. Write for complete information.

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CIRCLE INFORM-A-GRAM KEY NO. 123

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LOWEST IN THE INDUSTRY
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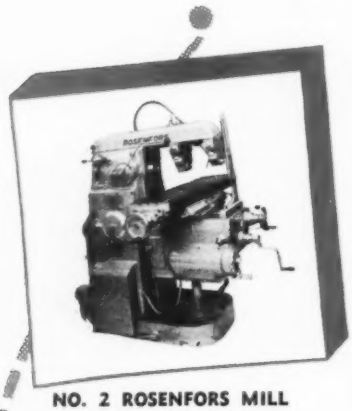


NO. 2 ROSENFORS MILL

Dial feed and speed controls. Rapid traverse. Table size 12" x 51". Spindle taper No. 50 National. Spindle speeds 18 or 36. 16 feeds. All gears hardened and ground, all shafts mounted in roller bearings. Weight 4500 lbs.

COMPLETE PRICE
no extras $8100

ABENE MILL

Vertical, Horizontal and Angular Combination Mill. Power longitudinal feed, coolant system, 4 H.P. spindle motor, overload protection and push button controls. Spindle is No. 40 N.T. Table size 10" x 40".

COMPLETE PRICE
no extras $4450

Ball MACHINERY COMPANY

All types of Metal working Machinery New and Used

939 W. Lake St. Chicago 7, Ill.
SEeley 8-1108

Complete facilities for service & parts

CIRCLE INFORM-A-GRAM KEY NO. 124

A Plan for Safer Plants

Keep Everyone Posted

Last of a series* prepared with the cooperation of the Greater Cleveland Safety Council

THE BEST WAY TO TEACH the other fellow is to tell him or show him. It's the same way with development of what the experts call "safety consciousness." Safe work methods and habits, they maintain, are largely the result of a successful communications program. People have to be told — and re-told — about safety and their jobs.

Regular discussions with employees, whether individually or in groups, are important. Here is a plan recommended by the Greater Cleveland Safety Council, in its "Patterns for Progress" program:

There should be a safety discussion with each employee at least once a month; more often if the employee is in a hazardous job or if he is observed doing something in an unsafe manner.

In companies which have programs involving mandatory individual safety contacts with employees, a management representative — usually the employee's supervisor — is required to talk to at least one to three employees on some specific phase of safety each day. In many plants, a record of these contacts is reviewed by the department head or other supervisor.

In addition to talking about the hazards of a specific job and any unsafe acts the employee may have committed, here are a few topics for such individual "safety clinics":

- New tools and equipment ordered or installed to permit safer work.
- What methods or procedures the employee thinks are necessary for improved safety.
- How the last departmental personal injury or dangerous property accident occurred and how it could have been prevented.
- What new work methods have been installed as a result of accident investigations.
- Subjects taken from various safety pamphlets and booklets.

Group discussions can be extremely effective if the leader takes time to plan them. Schedule such sessions in advance; select an area as free of noise, hazards, and traffic as possible; and provide seats, if possible. In addition, the leader should remember to keep the meeting group small in an effort to encourage a thorough discussion of the subject being covered and to foster audience participation. Slides, photographs, diagrams, charts, and other visual aids make safety meetings more interesting and help the employees to retain the information discussed. Length of such group meetings should not exceed 15 or 20 min.

Subjects for group discussions can be the same as those listed for individual discussion. The safety graphs and five-minute talks available from the National Safety Council, contain excellent material for group meetings.

A good way to coordinate job safety discussion topics is to plan to cover one major subject each month or during each meeting. For instance, use a theme such as "Learn the Safe Way To Do Your Job Before You Start" or "Wear Proper Clothing and Protective Equipment." The Safety Council has posters, employee handouts, and booklets for discussion leaders available for such meetings.

*See also TOOLING & PRODUCTION, Apr. '57, p 110; June '57, p 102; Aug. '57, p 100.

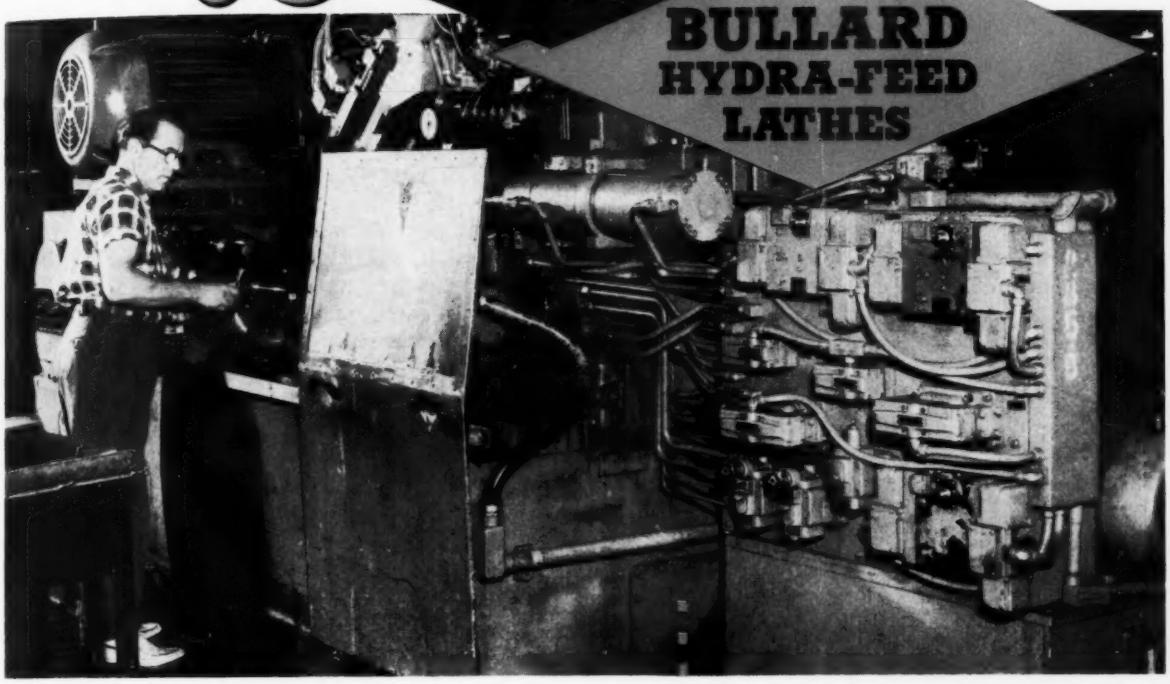
They'll Help . . .

. . . by supplying additional material for your plant safety program, such as instruction manuals, booklets, and posters:

- National Safety Council
  425 N. Michigan Ave.
  Chicago 11, Ill.
- American Society of Safety Engineers
  425 N. Michigan Ave.
  Chicago 11, Ill.
- State Industrial Commissions
- State and Local Safety Councils
- American Standards Association
  (Standard Accident Record-Keeping)
  70 E. 45th St.
  New York 17, N. Y.

saves 75% on changeover time with . . .

simplified set-up on BULLARD HYDRA-FEED LATHES



Illustrated below is one of more than forty different pinions processed on the same Bullard Hydra-Feed Lathes.

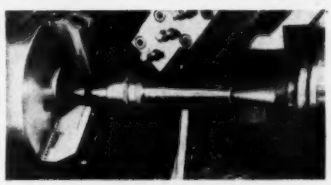
"Unless the consecutive set-ups from one job to another were similar," reports the Foreman of a large midwestern automotive parts manufacturer, "changeover set-ups took from ten to sixteen hours. But now, with Bullard Hydra-Feed Lathes, and going from one extreme to the other, **the changeover is accomplished in less than four hours.**"

Additional reasons for their enthusiastic acceptance of Bullard Hydra-Feed Lathes include less spoilage, greater accuracy, better finishes and reduced machining time over previous method.

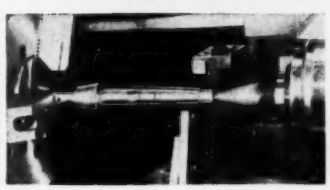
These advantages can be applied to your machining requirements. Call your nearest Bullard Sales Office for full particulars or write

FIRST CHUCKING

SECOND CHUCKING



FINISHED PIECE



THE BULLARD COMPANY
BRIDGEPORT 9, CONNECTICUT

Remember—to cut costs when cutting metal—buy **BULLARD**

CIRCLE INFORM-A-GRAM KEY NO. 125

Accordion Sleeves

Protect Vital Machine Parts

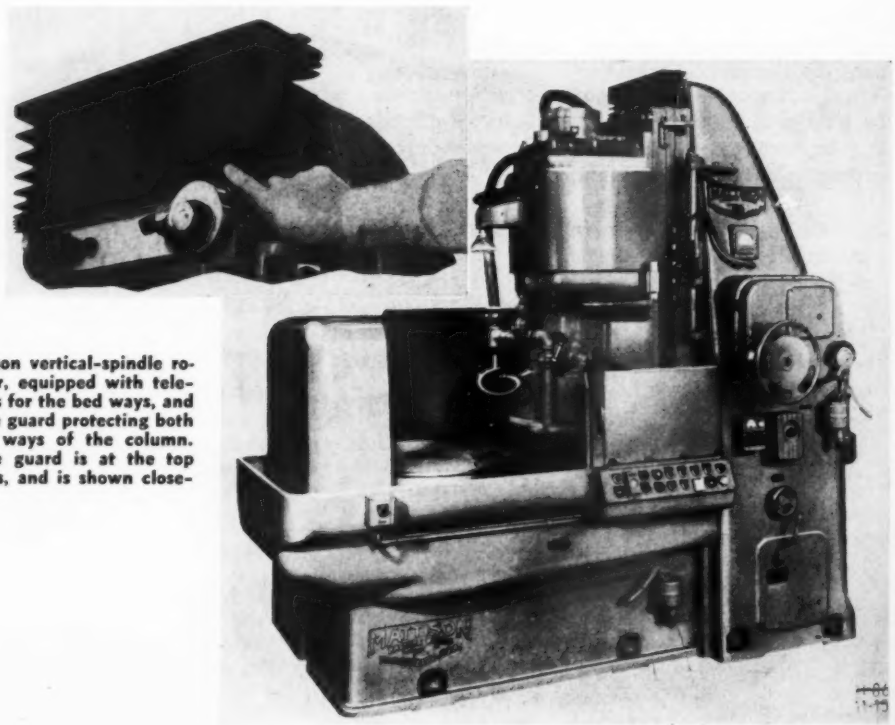
EARLY CONCEPTS OF MACHINE COMPONENT PROTECTION, exclusive of guarding against overload, had to do chiefly with belt-type coverings for flat horizontal grinder ways and tube type members for shielding important machine screws from abrasive dust and dirt. Today's accordion-type sleeves and protectors are more versatile than these, allowing for extreme amounts of opening and closing, where necessary, on machine tools and many other types of industrial, agricultural, and construction equipment. Telescopic sleeves on one testing machine, for example, open to 80″ and close to 3½″.

Protectors are available for operation in horizontal, vertical, or angular positions. Some are designed to completely encircle a part, being made with zippers to allow for installation in the field without tearing down a machine. Sleeves of considerable length, employed for horizontal operations on Acme threads and worm screws, are sometimes made with internal guide collars. Special shapes are developed where needed, as for instance where a closure for a rock crusher is made elliptical in shape to provide necessary flexibility.

Accordion-type protectors are made chiefly from a Neoprene-base material, suitable for withstanding temperature extremes from —60°F to 220°F without cracking. Coatings

. . . *Continued on page 128*

Photos courtesy A & A Mfg. Co. and Mattison Machine Works



A view of a Mattison vertical-spindle rotary surface grinder, equipped with telescoping steel guards for the bed ways, and with a bellows-type guard protecting both the "V" and flat ways of the column. The accordion-type guard is at the top of the column ways, and is shown close-up in the inset.

HERE'S PROOF OF PERFORMANCE . . .

"Our Men Use CLAUSING MILLS for every job that has to be on the nose"

"Our men use Clausing vertical mills rather than our larger, more expensive machines for every job that has to be 'on the nose'. We have yet to find a more accurate mill."

Wayne Fabricants
Ontario, New York

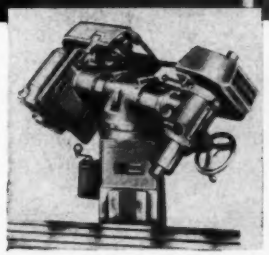
This report is typical of the experience of hundreds of users. The CLAUSING VERTICAL MILLER is a precision machine tool especially designed for general production milling . . . pattern, experimental and tool room use. Many new and exclusive features give it greater versatility, ease of set-up and operation than have ever been available in a miller at or near its price — only $835.00.

And Clausing is the most accurate machine of its type and capacity.

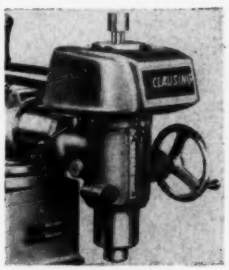
Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. **Top of table perpendicular to column ways within .0005" in 6" travel.**
2. **T-slots square with cross slide dovetails within .0005".**
3. **Table, parallel to turret within .001".**
4. **Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.**
5. **Spindle taper (internal) run out within .0002 at spindle nose.**
6. **Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.**

MILLS, DRILLS, BORES, REAMS, SHAPES AT ALL ANGLES . . . WITH ONE WORK SET-UP!



The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to mill, drill, bore, ream and shape at all angles with one set-up. Quill has micrometer depth control stop and two feeds, lever and hand wheel.



The heart of the CLAUSING MILL is its rigid, high precision spindle head. It has 7 ball bearings . . . spindle is chrome nickel steel, hardened and ground . . . quill, ground and hard chrome plated, has full-length bearing seat . . . overarm is an electric furnace casting, with ¾" thick walls, precision ground.

CONDENSED SPECIFICATIONS

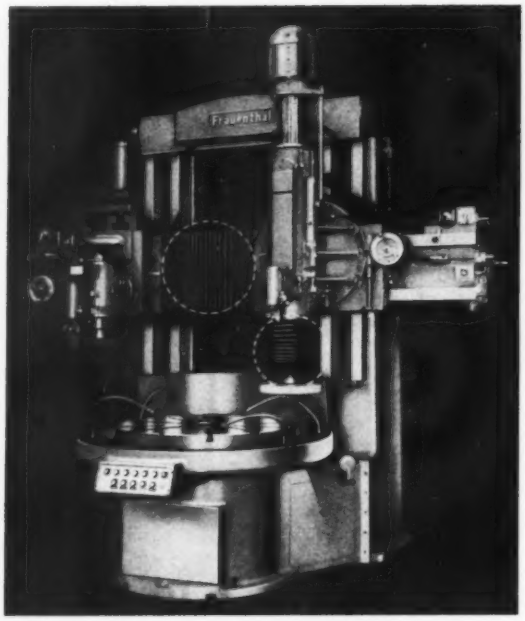
Size of Table	6" x 24"	Vertical Table Travel	11⅝"
Longitudinal Table Travel	15"	Max. Distance Spindle to Column	8¾"
Cross Table Travel	5"	Spindle Travel	3"

Spindle Speeds: Six, 180 to 3250 RPM. No. 7 Brown and Sharpe or No. 2 Morse Taper Spindle Optional. Operates from ½ to ¾ H.P., 1725 RPM motor.

FOR ILLUSTRATED LITERATURE

CLAUSING DIVISION • ATLAS PRESS COMPANY
10-115 N. PITCHER ST., KALAMAZOO, MICHIGAN

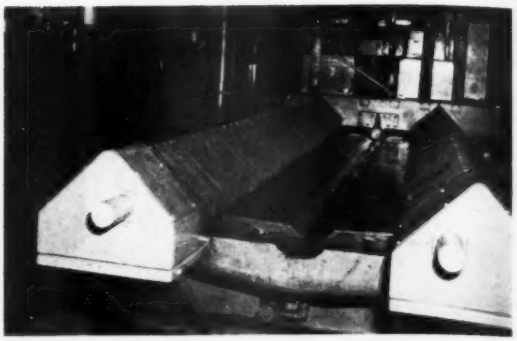
CIRCLE INFORM-A-GRAM KEY NO. 127



The dotted circles show where accordion-type protectors are used on this Frauenthal grinder, which is used to grind delicate large-diameter work, internally and externally. A vertical sleeve is applied to a downward feeding spindle in the smaller circle. The so-called L-type protector is over the crossrail in the larger circle.

are sometimes applied to make closures airproof or flame-resistant.

Some of the earliest accordion-type sleeves probably were applied to piston rods operating in locations exposed to abrasive dust. Even today, the chief emphasis is on use of bellows-like protectors to shield against abrasive dust and chips. Nevertheless, it is often important to shield machine parts from other elements such as water, oil, heat, acid fumes, etc.

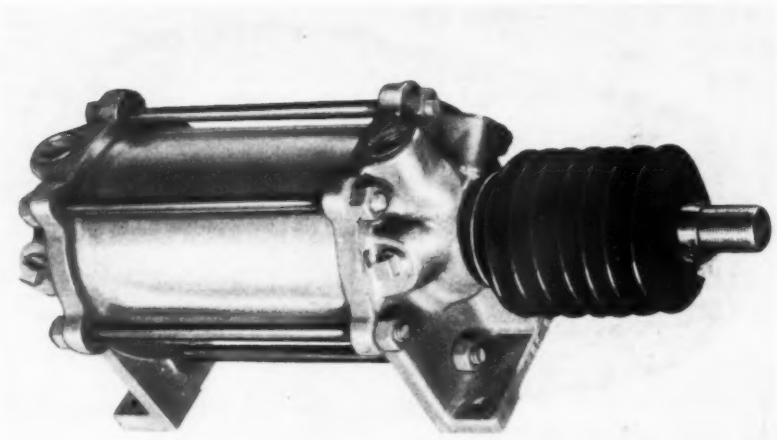


An interesting view of some special accordion-type protectors developed for the ways of a Giddings & Lewis horizontal boring and milling machine.

A large amount of importance is naturally attached to the adequate protection of vital components on grinding machines. Some of the most up-to-date surface grinders, such as Mattison's vertical spindle grinders, show good examples of the application of accordion-type sleeves of Neoprene-based material to protect the vertical ways.

A new telescoping steel guard developed for these machines, protects the grinder's lower bed ways, never allowing them to be exposed at any point during traverse of the carriage carrying the rotary table under the grinding wheel. Wear and maintenance, therefore, are greatly reduced, insuring a high degree of accuracy for longer periods of time.

While grinding machines profitably use accordion-type protectors, there are various other applications for them in the metalworking field: on lead screws of large rolling mills, on spar and skin milling machines, and horizontal boring and milling machines, for example.



Here is shown a telescopic sleeve applied for protection of a power cylinder piston and seals.

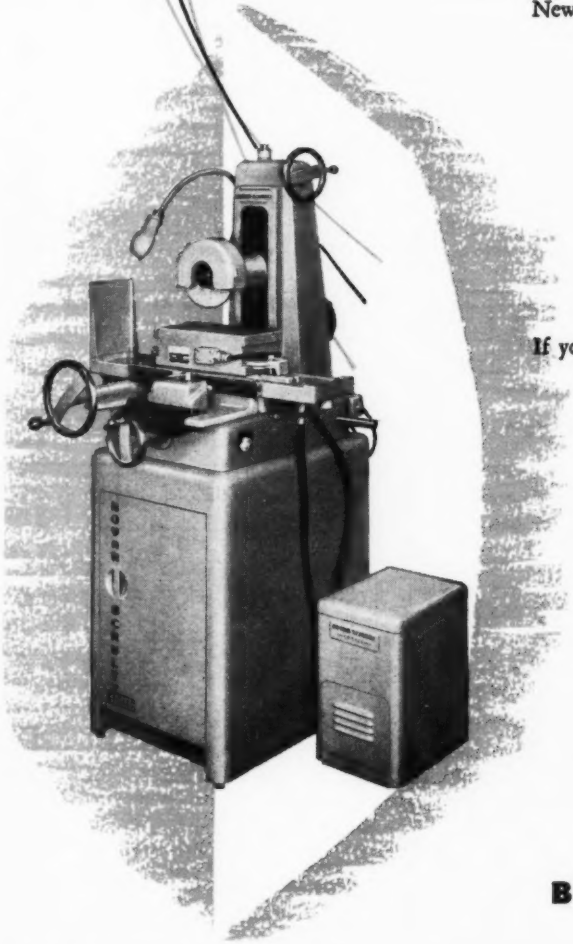
In One Year!...

"Our Boyar-Schultz 6 x 12 Surface Grinder Paid For Itself and Saved Us $4197.30" *

The above statement, part of a testimonial from Mr. Norman J. Bottie, General Manager of the Industrial Mica Corporation, Englewood, New Jersey, indicates the regard our customers have for the Boyar-Schultz 6 x 12 Surface Grinder.

This grinder has been in constant service sharpening mica stamping dies, which require the best in high precision equipment.

Mr. Bottie also states, "I might say that besides the savings we have received, we have had one full year with no breakdowns what-so-ever, not even a minor repair."



If you have a precision grinding problem, write for our FREE Catalog, describing the Boyar-Schultz 6 x 12 Surface Grinder.

6x12 SURFACE GRINDER

Hydraulic or Hand Feed Available

- SURFACE GRINDERS
- HIGH SPEED GRINDING ATTACH.
- PROFILE GRINDERS
- LEAD SCREW TAPPING ATTACH.
- HYDRAULIC BAR FEED
- SCREW MACHINE TOOLS
- TURRET LATHE TOOLS

BOYAR-SCHULTZ CORPORATION

2012 South 25th Ave.

Dept. C-M, Broadview, Illinois

* ATTESTED FIGURES AVAILABLE ON REQUEST

CIRCLE INFORM-A-GRAM KEY NO. 129

Now! A Complete Line of Self-Locking Microsize UNBRAKO Socket Cap and Set Screws

Nos. 0, 1, 2 and 3 in alloy steel and stainless steel are available with the Nylok* feature

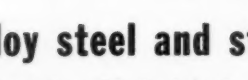
You effect major economies in time and money when you design and assemble small devices with self-locking microsize UNBRAKO socket screws. These close tolerance screws won't work loose. They simplify standardization of small devices where maximum reduction of weight is required without sacrifice of strength. They eliminate the necessity of designing costly special screws to fasten tiny parts in compact assemblies and they prevent the waste of production time while waiting for delivery of special screws.

In addition to having the overall advantages of microsize UNBRAKO socket screws, these screws can be used in holes tapped in soft or die cast materials without stripping threads and ruining expensive work. Also the set screws can be used with hardened shafts, since they lock against the threads of the tapped hole.

All UNBRAKO socket screws can be supplied with the self-locking Nylok feature. The UNBRAKO with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Seated or not, the screw locks positively wherever wrenching stops, won't work loose—because the tough resilient nylon pellet forces mating threads together.

Ask your authorized industrial distributor for details today. He carries complete stocks of self-locking UNBRAKO socket screws (caps and sets from #0 through 1 in., button heads #4 through ⅜ in., flat heads from #4 through ¾ in.). Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.

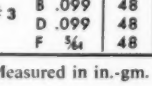
*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO Socket Cap Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque: Max. prev. on	Torque: 1st off stat. min.	Torque: 5th off stat. min.
#0	A .104	—	80	1/8	—	.047	5.5	14.0*	7.0*
	B .060	—	80	3/16	—	.047	5.5	14.0*	7.0*
	D .060	—	80	1/4	—	.047	5.5	14.0*	7.0*
	F .050	—	80	3/8	—	.047	5.5	14.0*	7.0*
#1	A .118	—	72	1/8	—	.047	11.0	28.0*	14.0*
	B .073	—	72	3/16	—	.047	11.0	28.0*	14.0*
	D .073	—	72	1/4	—	.047	11.0	28.0*	14.0*
	F .050	—	72	3/8	—	.047	11.0	28.0*	14.0*
#2	A .140	56	—	3/16	.063	—	24.0	3.0	1.5
	B .086	56	—	1/4	.063	—	24.0	3.0	1.5
	D .086	56	—	3/8	.063	—	24.0	3.0	1.5
	F 1/16	56	—	1/2	.063	—	24.0	3.0	1.5
#3	A .161	48	—	3/16	.063	—	40.0	6.5	3.0
	B .099	48	—	1/4	.063	—	40.0	6.5	3.0
	D .099	48	—	3/8	.063	—	40.0	6.5	3.0
	F 5/64	48	—	1/2	.063	—	40.0	6.5	3.0

*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO Socket Set Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque: Max. prev. on	Torque: 1st off stat. min.	Torque: 5th off stat. min.
#0	D .060	—	80	3/32	—	.047	5.5	14.0*	7.0*
	F .028	—	80	1/8	—	.047	5.5	14.0*	7.0*
		—	80	5/32	—	.047	5.5	14.0*	7.0*
		—	80	3/16	—	.047	5.5	14.0*	7.0*
		—	80	1/4	—	.047	5.5	14.0*	7.0*
#1	D .073	—	72	1/8	—	.062	11.0	28.0*	14.0*
	F .035	—	72	5/32	—	.062	11.0	28.0*	14.0*
		—	72	3/16	—	.062	11.0	28.0*	14.0*
		—	72	1/4	—	.062	11.0	28.0*	14.0*
#2	D .086	56	—	1/8	.062	—	24.0	3.0	1.5
	F .035	56	—	5/32	.062	—	24.0	3.0	1.5
		56	—	3/16	.062	—	24.0	3.0	1.5
		56	—	1/4	.062	—	24.0	3.0	1.5
#3	D .099	48	—	5/32	.093	—	40.0	6.5	3.0
	F .050	48	—	3/16	.093	—	40.0	6.5	3.0
		48	—	1/4	.093	—	40.0	6.5	3.0

*Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

Self-locking microsize UNBRAKO socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel (plated or unplated) and stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking UNBRAKO socket screws.

We also manufacture precision titanium fasteners. Write for free booklet.

sps **Jenkintown • Pennsylvania**

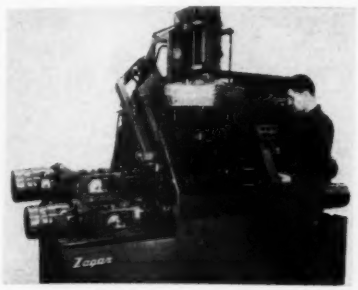
Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co., Inc. • Cooper Precision Products • Standco Canada Ltd. Unbrako Socket Screw Co., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 130

FLAT STOCK PROCESSED ON FOUR STATION TRANSFER MACHINE

Simultaneous multi-hole drilling and reaming from three sides are featured in this machine, in addition to tapping. The piece processed is a rectangular, bar-shaped lawn mower part.

At the first station, a single hole is drilled in each end of the part. At station two, the drilled holes in the ends are reamed simultaneously with the drilling of eight holes on the flat side of the part. The eight holes are drilled by a multiple-spindle drill



head located at the rear of the machine. At the third station, the eight holes drilled at station two are tapped by a drill head found at the front-top position of the machine. At station four, loading and unloading of the fixture is done.

This transfer machine has gearless head multi-spindle and single spindle drilling, reaming and tapping components made by the manufacturer, Zagar, Inc. The machining cycle is fully automatic and electrically interlocked. Tooling is adjustable for parts ranging from 12" to 24" in length.

SILVER BRAZING AND SEMI-AUTOMATIC TEST SPEED PAN ASSEMBLY

Silver brazing is providing a quick, strong, and permanently leak-free joint between a transmission oil pan and its drain bushing. The brazing method used by Buick to secure a 1½" bushing in a drawn steel pan is followed by a semi-automatic, 100% inspection for leaks.

Processing begins with degreasing, after which the pan and bushing receive a coating of Handy-Flux. A ring of 3/16" round Easy-Flo 45 silver brazing alloy is placed on the bushing and both are inserted from the inside through the hole in the pan.

Brazing is done on a two-station 25-kw Welduction machine with two induction coils at each station. The

. . . *Continued on page 134*

DALZEN

2 in 1 COMBINATION
CENTER GRINDER & DRILL PRESS

A drill press and center lapping machine at less than the cost of many single purpose center grinders! In addition to savings on equipment costs, the Dalzen "2 in 1" permits maximum man-hour production thereby keeping your unit cost at a minimum!

1 SIMPLE OPERATION CHANGES CENTER GRINDER TO DRILL PRESS

Center grinder to drill press or drill press to center grinder in a matter of seconds! Simply unlock clamping handle and swing diamond dresser in or out of position! Photo at left shows center grinder in dressing position. Photo above shows center grinder at work.

A full 43" capacity from base to spindle . . . dresser adjustment from 20° to 100° included angle . . . drills to center of 15" circle . . . maximum lapping stone dia. 3".

THREAD GRINDER

Average Set-Up Time 30 Minutes! Saves Floor Space! Low Cost!

Excellent for tool room and production Thread Grinding. Easily set-up from job to job! Has built-in relieving attachment as standard equipment for grinding of taps. This remarkable machine may also be used to grind angles, grooves and surfaces where concentricity is an important factor!

Dresser and wheel head are self-compensating. Size of work is automatically maintained after dressing of wheel regardless of how much is dressed off.

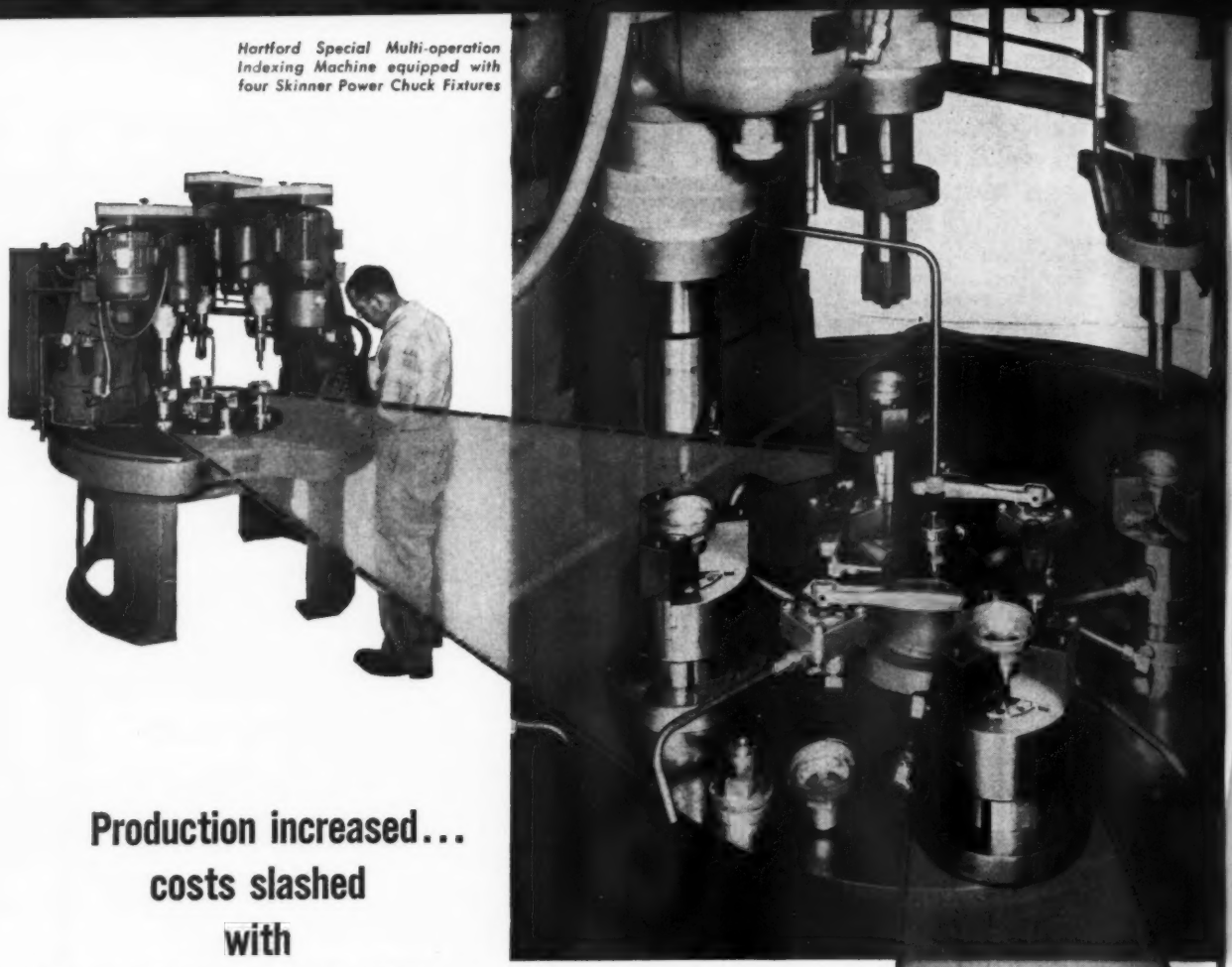
The grinding and regrinding of thread rills up to 3" in diameter and thread milling cutters can also be ground with special attachment.

WE ALSO SPECIALIZE IN THREAD ROLLING DIES AND THREAD HOBS
LITERATURE ON REQUEST

DALZEN MANUFACTURING CO.
4600 BREE ROAD, DEPT. TP-10
ST. CLAIR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 131

Hartford Special Multi-operation Indexing Machine equipped with four Skinner Power Chuck Fixtures



Production increased... costs slashed with Skinner Power Chuck Fixtures

Four Skinner Power Chuck Fixtures mounted on an index table recently helped Hartford Special Machinery Company develop a low-cost, high-production machine for a customer that assured top quality at a lower part cost.

In this application, each Power Chuck Fixture holds a work piece and is indexed to three working stations for machining.

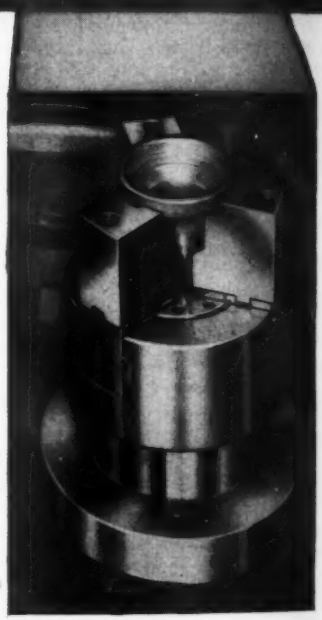
The operator has only seven seconds to unload and load, yet can keep up the pace all day long, thanks largely to the effortless releasing and gripping of the air-powered fixtures.

Skinner Power Chuck Fixtures are compact, but versatile enough to hold up to 15 sizes of the customer's work pieces, if need be. At the same time, they can be used to grip a wide variety of other work for drilling, machining, or assembly operations.

See how you, too, can profit from the accuracy, speed and strength of Skinner Power Chuck Fixtures. Send for Catalog No. 68P, which gives the details of all Skinner Chucks and Fixtures. Write Dept. 190.

Non-rotating Skinner Power Chuck Fixtures are ideal for holding work on drilling and milling machines, for assembly operations and for other bench and machine installations.

They're operated by air for fast, effortless loading and unloading. The compact units are available in several sizes, with either two or three adjustable or non-adjustable jaws.



Skinner Power Chuck Fixtures are available through leading Industrial Distributors everywhere.

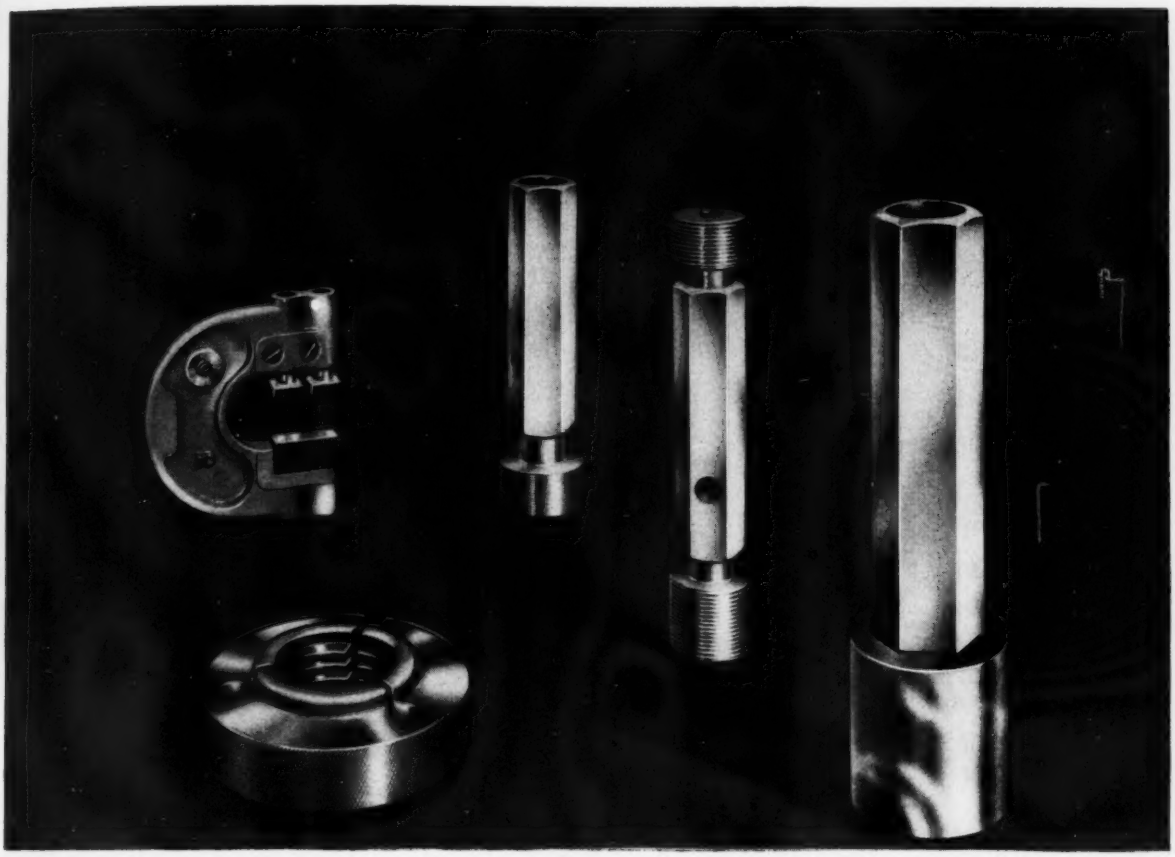
SKINNER CHUCKS

THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

THREADWELL GAGES



ACCURACY you can trust at a price you can afford . . .

CONTROLLED DIMENSIONAL STABILITY guarantees the accuracy . . .

LONGER WEAR LIFE makes your gage dollar go farther . . .

- *Plain Cylindrical Plug Gages*
- *Taper Plug and Ring Gages— Master Setting Disks*
- *Plain Cylindrical Ring Gages*
- *Adjustable Limit Gages*
- *Thread Gages*
- *Thread Checking Equipment*
- *Pipe Thread Gages*

SEE YOUR THREADWELL DISTRIBUTOR NOW

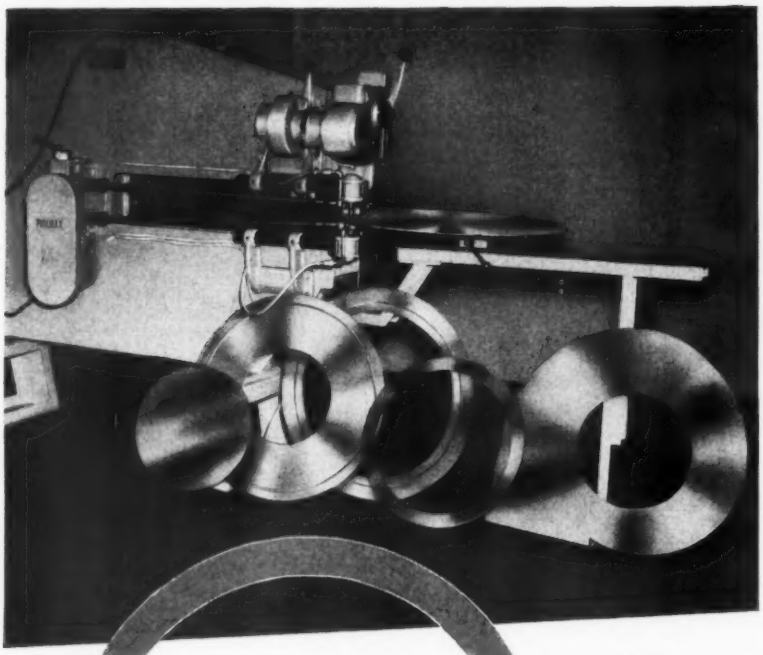
Threadwell

THREADWELL TAP & DIE COMPANY
Greenfield, Mass., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 133

PULLMAX-First in Circle Cutting

Less Weight • Less Floor Space • Twice the Speed • Half the Cost!



PULLMAX
cuts 36″ circles
in 3/8″ MILD STEEL
in 30 seconds

With the amazing PULLMAX Heavy Duty machines, you can cut circles to practically unlimited sizes with the utmost accuracy.

With the power feed and outside attachment PULLMAX has proved itself the fastest, most modern and accurate ring and circle shear.

A PULLMAX Machine with a power feed that operates at various speeds up to 32 lineal feet per minute and a simple outside attachment is an investment of roughly ½ the cost of other ring and circle shears.

and the same Pullmax machine also does:

straight shearing • irregular cutting • louver cutting • dishing
joggling • slot cutting • beading

Write for literature and prices today.

We'll be glad to send the Pullmax Mobile Demonstrator to your plant—just write or call.

AMERICAN PULLMAX COMPANY INC
2469 North Sheffield Avenue • Chicago 41, Illinois

"See us at the 39th National Metal Exposition, International Amphitheatre, Chicago, Ill., Nov. 4-8, Booth No. 1065."
CIRCLE INFORM-A-GRAM KEY NO. 134

. . . Brazing from page 131

pan assembly is positioned vertically on the coil, Figure 1, so that the alloy will be drawn through the joint and around the protruding edge of the bushing. The automatically timed brazing cycle for each two unit station provides a total production rate for both stations of 240 joints/hr.

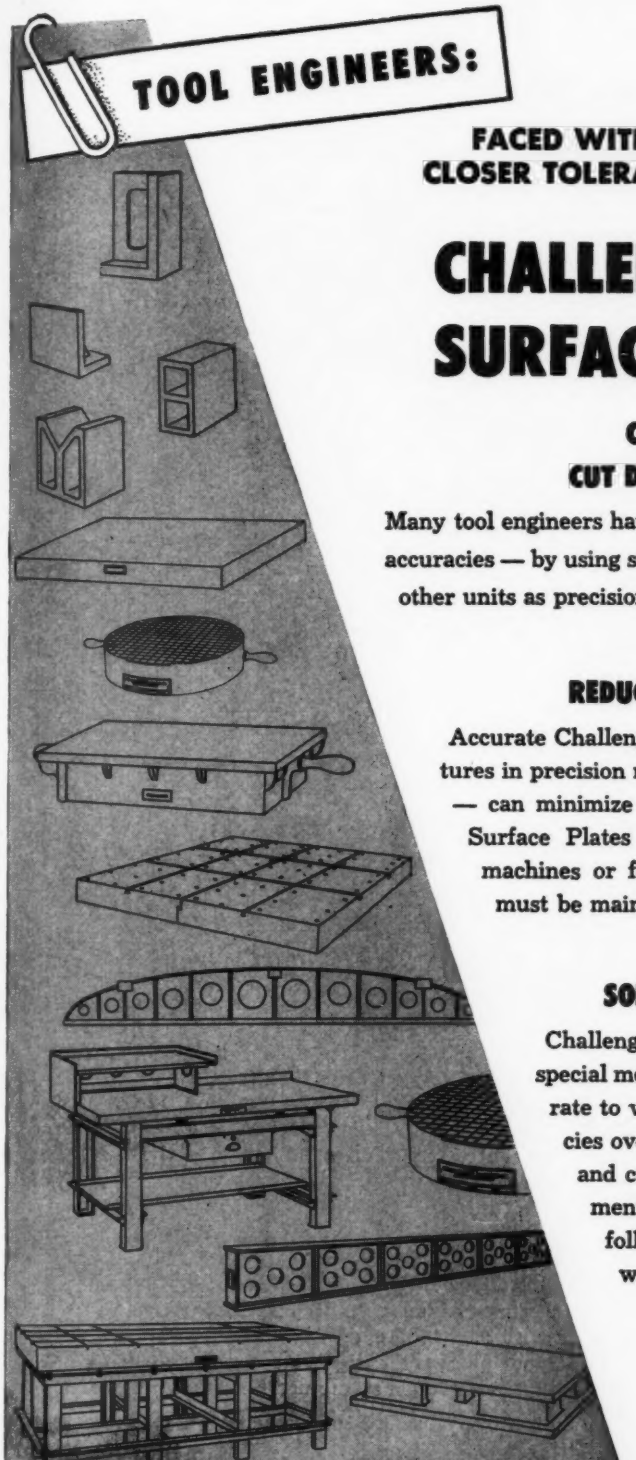
Flux is removed while still warm in a solution of soluble oil and water, and the pans are taken to the test machine. One cycle in this pneumatically operated machine handles 3 pans which are positioned open-side down on rubber pads, Figure 2. Frames descend and press the pan flange against the pad forming an air seal. Toggle mounted rubber discs seal the bushing opening, and the entire assembly is lowered into the test tank. Air is admitted into the pans through jets in the pads, and defective brazing, which is usually less than 1%, shows up as a train of bubbles.

Superfinishing of guide pins on all Superior die sets is announced by Superior Steel Products Corp., Milwaukee. With super finished guide pins, ideal clearances can be maintained due to greater bearing surface. A high lustre microfinish results in maximum surface hardness, increased bearing surface, longer pin and bushing life, greatly reduced possibility of scoring, and smoother over-all action.

TOOL ENGINEERS:

FACED WITH A PROBLEM OF HOLDING CLOSER TOLERANCES IN YOUR OPERATIONS?

CHALLENGE PRECISION SURFACE EQUIPMENT



CAN HELP YOU . . .
CUT DOWN TOOLING COSTS

Many tool engineers have found they can cut tooling costs — and increase accuracies — by using standard Challenge Angle Plates, Box Parallels, and other units as precision bases for building precision jigs and fixtures.

REDUCE MANUFACTURING REJECTS

Accurate Challenge Surface Equipment — used both as holding fixtures in precision machining, or for accurate assembly and inspection — can minimize rejects . . . save manufacturing costs. Challenge Surface Plates can also be used as bases for small standard machines or for larger machine tools where precise alignment must be maintained.

SOLVE SPECIAL MEASUREMENT PROBLEMS

Challenge has supplied many types of precision surfaces for special measurement problems. Semi-steel surfaces . . . accurate to within .0002" over several feet, or to lesser accuracies over large areas . . . have been provided for standard and custom applications. If you have a special measurement problem—check Challenge first! Send for the following catalog of standard precision equipment or write . . .

Challenge®

THE CHALLENGE MACHINERY CO.
GRAND HAVEN, MICHIGAN

DEPT. TP-10

THE CHALLENGE MACHINERY CO.
GRAND HAVEN, MICHIGAN

Send Challenge Precision Equipment Catalog 838W

Name_____ Position_____

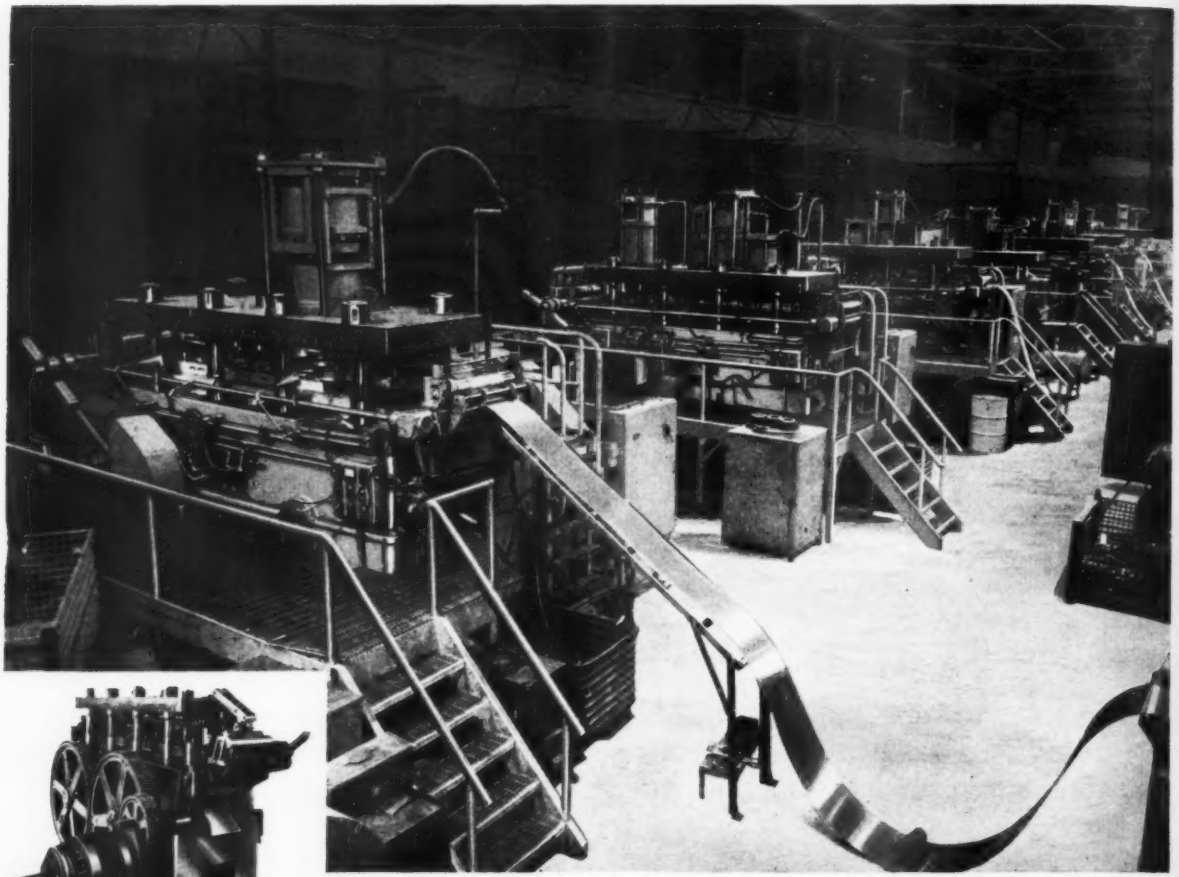
Company_____

Address_____

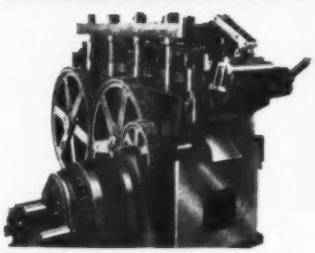
City_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 135

Seven 300-Ton Brandes Presses at FORD Stamp Huge Runs on 12′ Progressive Dies



Courtesy of Ford Motor Co., Monroe, Michigan



Rear View of one of the above Brandes 300-Ton Double Crank Presses.

Illustrated above are Brandes 300-Ton Double Crank Presses at the Ford Stamping Plant, Monroe, Michigan. These presses utilize 9-station, 12-ft. progressive dies to produce headlamp housings, hub caps, ball ring retainers at 24 to 28 strokes per minute. The tremendous length of the dies (***Brandes designed and built the first 12-ft. die***) plus the extreme accuracy of alignment built into the press give phenomenal runs between grinds. The overall height of these Brandes 300-Ton Double Crank Presses is only 9 ft. These presses are *not* installed in pits, giving greater versatility and low cost installation. Designed for versatility and proven in production for over 5 years, the installation at Ford permits continuing stamping economies with only tooling changes for new styles and models. Brandes will build your press and design your tooling to give you the greatest cost savings in progressive die stampings.

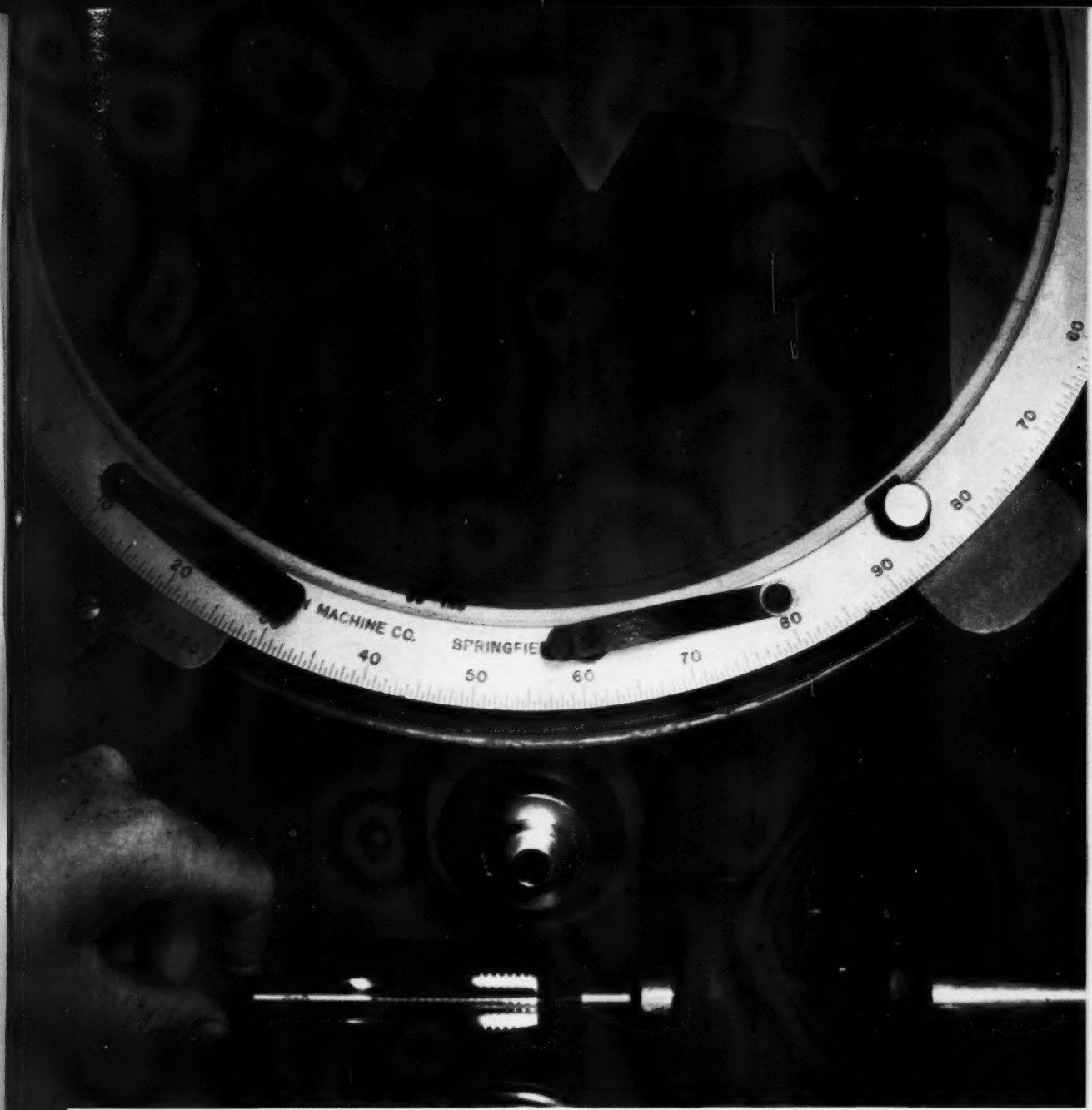
Brandes Builds Presses from 30-ton to over 4,000-ton capacity.

The BRANDES PRESS CO.

6408 EUCLID AVENUE, CLEVELAND 3, OHIO

Write for NEW SPECIFICATION Catalog 109-9-57

CIRCLE INFORM-A-GRAM KEY NO. 136



Chamfer "run out" in a tap is the deviation in chamfered thread height from one land to another in relation to the axis. If present to an appreciable degree, this eccentric condition affects hole size and may cause bell mouth in threaded holes and rapid wear on the cutting teeth of taps.

Inspection of chamfers, enormously magnified, is another of the careful quality control checks at "Greenfield" which assure that the taps you buy are as free from faults as constant vigilance can make them.

IF IT CAN BE MEASURED **GREENFIELD** *MEASURES IT*

GREENFIELD TAP and DIE CORP.
GREENFIELD, MASS.

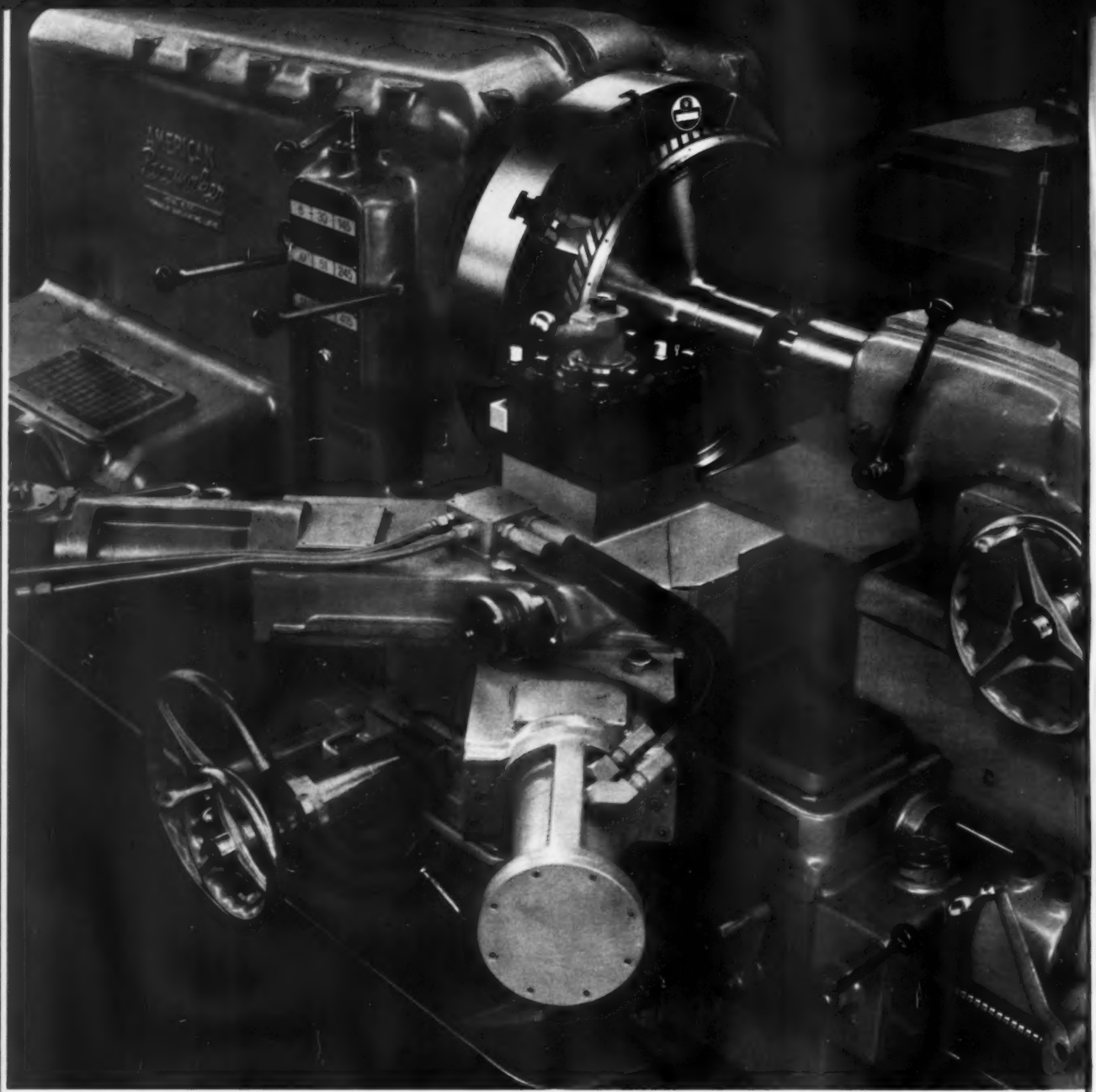


Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON CHUCK DIVISION
Greenfield Tap and Die Corporation
Windsor Locks, Connecticut

HORTON
Since 1851
CHUCK

Call Your Horton Distributor Now!

— SAVE THIS AD FOR FUTURE REQUIREMENTS — DEALERS INQUIRIES INVITED —

NEW SIZES ADDED DAILY . . . IF NOT LISTED HEREIN — INQUIRE

WHY WAIT FOR SPECIAL

High Speed Steel Taps and Dies and Thread Plug Gages?

In Stock For Immediate Delivery

RIGHT HAND TAPS AND THREAD PLUG GAGES

Size	Threads Per Inch
00	90-96
0	56-64-72
1	56
2	60-72
3	40-60-64
4	32-42-44-56-60-64
5	30-32-36-48-56-80
6	30-36-38-42-44-48-56-60-64
7	28-30-32-34-36-38-40
8	24-26-30-36-40-44-48-56-60-64-80
9	24-28-30-32-40
10	18-20-22-26-28-30-36-40-48-56-64
11	20-22-24-28-30
12	20-22-26-27-30-32-36-38-40-48-56
13	20-22-24-32
14	16-18-26-28-30-32
15	18-20-24
16	16-18-20-22-24
17	16-20
18	16-18-20-24
19	18-20
20	16-18-20-24-32
22	16
24	14-16-18-22-24
26	14-16
28	14-16
30	14-16
1/16	56-60-64-72
5/64	56-60-64-72
3/32	38-48-50-56-60-64
.107	32
7/64	36-40-42-44-48-50-56
1/8	32-36-40-48
.132	30
9/64	30-32-38-40
5/32	24-26-28-30-32-36-38-40
11/64	24-26-30-32-36-38-40
3/16	12-18-20-22-24-26-28-30-32-36-40
.198	24
13/64	24-28-30-32
7/32	20-22-24-26-27-28-30-32-36-38-40
.227	24
15/64	20-24-28-32-40
1/4	16-18-22-23-24-25-26-27-30-32-36-40-41-51-55-60
17/64	18-20-27-28
.269	36
.277	40
9/32	18-20-24-26-27-28-32-36-40
19/64	18-24
.300	28
5/16	12-14-16-20-22-26-27-28-30-32-36-40-48-50-56
21/64	16-20-24
11/32	16-18-20-22-24-26-27-32-40
23/64	16-24
.365	28
3/8	12-14-18-20-22-26-27-28-30-32-36-40-48-56
25/64	16-24-27
.400	24
13/32	12-14-16-18-20-24-27-32-40
27/64	28
7/16	12-16-18-22-24-26-27-28-30-32-36-40
29/64	12
15/32	12-14-20-24-27-28-32-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
33/64	12-13-20
17/32	10-12-13-14-16-18-20-27-32-40
.550	24
9/16	13-14-16-20-24-27-28-30-32-40-48
37/64	12-27
19/32	12-18-20-24
5/8	9-10-12-13-14-16-20-24-27-28-32-36-40
41/64	11-18-24
21/32	10-11-18-20-27-32-40
11/16	20-.004
11/16	24-.010
11/16	11-12-14-16-18-20-24-27-28-30-32-36-40
23/32	11-16-20-27-32-36-40
47/64	10-16
3/4	9-11-12-14-15-18-20-22-24-26-27-28-32-36-40
49/64	10-16
25/32	10-16-20-27-32-40
.800	16
13/16	10-12-14-16-18-20-24-27-28-32-40
.822	8
27/32	10-18-20-27-32-40
7/8	8-10-11-12-13-16-18-20-24-26-27-28-32-36-40
.885	14
29/32	12-20-27-28
15/16	8-9-10-12-14-16-18-20-24-27-28-32-40
31/32	9-16-20-28-32
1	5-9-10-11-12-16-18-20-24-27-28-30-32-40-48
1-1/32	8-12-14
1-3/64	14
1-1/16	8-10-12-14-16-18-20-24-27-28-32
1-3/32	8-9-12
1-1/8	8-10-14-16-18-20-24-27-32
1-5/32	7-12-24-26-40
1-3/16	8-10-12-14-16-18-20-24-32
1.220	32
1-1/4	8-10-14-16-18-20-24-28-32
1-5/16	6-8-10-12-14-16-18-20-24-32-48
1-3/8	8-10-14-16-18-20-24-32
1-13/32	20
1-7/16	6-8-10-12-14-16-18-20-24-28-32
1-1/2	8-10-13-14-16-18-20-24-28-32
1-17/32	18
1-9/16	12-14-16-18-20-24-32
1-5/8	5½-8-10-12-13-14-16-18-20-24-28-32-40
1-11/16	10-12-14-16-18-20-24-32
1-3/4	5-8-10-12-13-14-16-18-20-24-28-32-40
1.7715	12
1.767	18
1-13/16	8-10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	32
1-15/16	8-10-12-14-16-18-20-24-32
2	4½-6-8-10-12-14-16-18-20-24-32
2-1/16	12-14-16-32
2-1/8	4½-8-10-12-14-16-18-20
2-3/16	12-16-20
2-1/4	4½-8-10-12-14-16-18-20
2-5/16	12-16-18-20
2.360	18
2-3/8	4-8-10-12-14-16-18-20
2-7/16	16-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	12-18
2-5/8	8-10-12-14-16-20
2-11/16	16
2-3/4	4-8-10-12-14-16
2-7/8	8-10-12-16
2-15/16	16
3	3½-4-8-10-12-16-18
3-1/8	12-16
3-3/16	20
3-1/4	4-8-10-12-14-16-18
3-3/8	10
3-1/2	4-8-12-16
3-3/4	4-8-12-16
4	4-8-12
4-1/8	12
4-1/4	8

LEFT HAND TAPS AND THREAD PLUG GAGES

Size	Threads Per Inch
0	80
1	56-64-72
2	56-64
3	48-56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-32-40
12	24-28-32-40
14	20-24
5/32	36
3/16	32-40
1/4	20-23-24-25-27-28-32-40-48
.277	40
5/16	18-20-24-27-28-32-40
11/32	24
3/8	16-20-24-27-32-40
13/32	20
7/16	14-20-24-27-28-32-40
1/2	12-13-14-16-20-24-27-28-32-40
9/16	12-18-20-24-27-32-40
.622	8
5/8	10-11-12-16-18-20-24-28-32
11/16	11-16-18-20-24-32
.720	8
.722	8
3/4	9-10-12-16-18-20-24-32
13/16	10-16-18-20
7/8	9-10-12-14-16-18-20-24-32
15/16	12-14-16-18-20-32
1	8-12-14-16-18-20-24-28-32
1-1/8	7-12-18-20-24-32
1-1/4	6-7-8-12-16-18-20
1-5/16	12-16-18-20
1-3/8	5-6-8-10-12-16-18-20-24
1-7/16	10-12-18
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	5½-8-10-12-16-18-20
1-11/16	8-10-12-16-18-20-24
1-3/4	5-8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	5-8-10-12-14-16-18-20
2	4½-8-10-12
2.215	20
2-7/32	20
2-¼	4½-8-12
2-5/16	24
2-½	4-8-12
2-11/16	16
2-3/4	4
2-7/8	24
3	4-8

RIGHT HAND—UNLISTED "GUN" OR SPIRAL POINTED TAPS

Size	Threads per Inch	Size	Threads per Inch
0	80 NF		
1	56 NS	⅞	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 14 NF
9/16	12 NC, 18 NF	1⅛	7 NC, 12 NF
⅝	11 NC, 18 NF	1¼	7 NC, 12 NF
11/16	11 NC, 16 NF	1⅜	6 NC, 12 NF
¾	10 NC, 16 NF	1½	6 NC, 12 NF

RIGHT HAND—UNLISTED "PULLEY" OR EXTRA LENGTH TAPS

Size	Threads per Inch	Size	Threads per Inch
4	40 NC, 48 NF	⅝	24 NF
5	40 NC, 44 NF	7/16	20 NF
6	32 NC, 40 NF	½	20 NF
8	32 NC, 36 NF	9/16	12 NC
10	24 NC, 32 NF	9/16	18 NF
12	24 NC, 28 NF	⅝	18 NF
¼	28 NF	¾	16 NF
5/16	24 NF	Also Larger Sizes NC & NF	

RIGHT HAND "PIPE" TAPS

TAPER "NPT" Size	TAPER "NPT" Thread	STRAIGHT "NPS" Size	STRAIGHT "NPS" Thread	EX. LENGTHS TAPER "NPT" Size	EX. LENGTHS TAPER "NPT" Thread
1/16	27	1/16	27	1/16	27
¼	27	1⅛	11½	⅛	27
2½	8	1½	11½	¼	18
3	8	2	11½	⅜	18
3½	8	2½	8	½	14
4	8	3	8	½	14
		3½	8	¾	14
		4	8	1	11½

LEFT HAND 'PIPE TAPS' TAPER AND STRAIGHT

Size	Thread	Size	Thread
1/16	27	1	11½
⅛	27	1¼	11½
¼	18	1½	11½
⅜	18	2	11½
½	14	2½	8
¾	14	3	8

"OVERSIZE TAPS"

RIGHT HAND N. C. and N. F. SIZES

MACHINE SCREW No. 2 TO No. 5 PLUS .002 TO .003

MACHINE SCREW No. 6 TO No. 14 PLUS .003, .005, .010

FRACTIONAL ¼" TO 1½" PLUS .003, .005, .010 AND .015

"UNDERSIZE ALSO AVAILABLE"

"PRICES OF SPECIALS ARE GOVERNED BY QUANTITY ORDERED" PRICES QUOTED UPON REQUEST

REGULAR LISTED SIZE TAPS AND TOOLS IN STOCK FOR IMMEDIATE DELIVERY

ACME TAPS AVAILABLE FOR QUICK DELIVERY

2 WEEKS DELIVERY—When ordering or requesting quotations, kindly furnish us with the following information:

(a) Kind of material being machined.
(b) Depth of hole, through or bottom.
(c) Tap to be used horizontally or vertically.
(d) Will tap turn, or is piece expected to be turned.
(e) Is tapping job expected to be done in one pass.
(f) Would tap be backed out of hole, or machine stopped for release of tap.
(g) If possible, submit thread length, and overall length of tap desired with a blue print.

SPECIAL REAMERS IMMEDIATE DELIVERY

H.S.S.S. MACHINE REAMERS DECIMAL, FRACTIONAL, LETTER, AND WIRE GAUGE SIZES
Prices On Application
Write for Our Stock List

SPECIAL — RIGHT HAND HIGH SPEED "EXTRA LENGTH DRILLS" In Stock for Immediate Delivery

WE ARE WELL EQUIPPED TO SUPPLY YOUR NEEDS IN ANY QUANTITY, PARTICULARLY WHEN YOU ARE IN A HURRY

The Largest Stock of

Special and Standard Taps, Dies, Plug Gages

RING GAGES 2 WEEKS DELIVERY

FIELD TOOL SUPPLY CO.

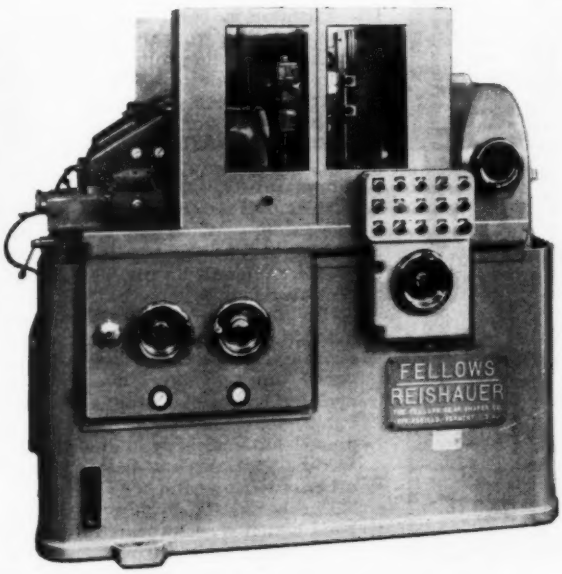
Industrial Cutting Tools

31 S. DES PLAINES ST., CHICAGO 6, ILL.

All Phones: Financial 6-1195

THE
PRECISION
LINE

Accuracy
Production Speed...
a cost saving combination.



FELLOWS-REISHAUER
Gear Grinding Machine
American-made by Fellows

Under license from the Reishauer Tool Works Ltd., Zurich, Switzerland, Fellows now manufactures the precision No. 12 Fellows-Reishauer Gear Grinding Machine.

An emery wheel, on which a helix has been developed, generates the gear tooth shape. The tooth section of the wheel is usually that of the basic involute rack. As the wheel turns in harmony with the work while the work passes axially by the wheel, an involute is generated.

Grinding is done in both directions of travel of the work-slide. Simple, fast machine set-up permits the economical grinding of single piece lots as well as the long production runs.

For grinding spur and helical gears up to 12" O.D. and 6¾" face width, the American-made Fellows-Reishauer is outstanding for combined speed and accuracy. Ask your Fellows representative about it.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

Fellows *Gear Production Equipment*

CIRCLE INFORM-A-GRAM KEY NO. 141

Scully-Jones Offers

PREMIUM CHUCK PERFORMANCE

AT NO PREMIUM IN PRICE!

These benefits . . .	for these reasons . .	result from these PREMIUM features
LONGER TOOL LIFE	Breakage reduced	1. New four-slot design increases resistance to pull-out approximately four times.
GREATER ACCURACY	Drills and taps run true	2. Greater number of slots permits chuck to close evenly on all sides and along shank of tool.
		3. Bore and shank are concentric within .002", gaged at distance equal to projection of standard jobber-length drill from the chuck.
	Accuracy of chuck lasts longer	4. Hardened alloy steel gives you best combination of spring collet action, high torsional strength, and sustained high accuracy.
INCREASED PRODUCTION	Downtime reduced	5. Improved seating and spring collet action of four-slot design facilitates easy tool changes.
		6. Four-way gripping action gives you greater protection against drill and tap breakage.

SCULLY JONES

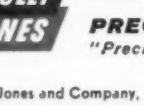
Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

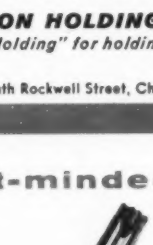
Scully-Jones and Company, 1913 South Rockwell Street, Chicago 8, Illinois

for profit-minded tool buyers!



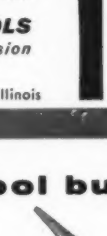
COUNTERBORES and COUNTERSINKS

Give you rigidity and concentricity needed for accurate work, longer life.



LIVE CENTERS

Take shock and abuse of heavy loads turning at high speeds.



"SCULLY-DRIFT" TOOL EJECTORS

Speed tool changes . . . protect tools, spindles, and bearings. Twist-of-the-wrist ejects tool or holder.

CENTER DRILL DRIVERS

Offset splined section gives positive drive in drill flutes and protects cutting edges.

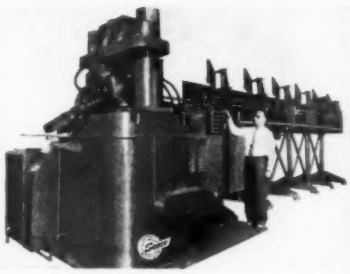
DRILL STOPS

Make control of drill depth simpler, more accurate. Sleeve snaps out for fast tool change.

CIRCLE INFORM-A-GRAM KEY NO. 142

BAR FEED PROCESSES RANDOM LENGTHS AND VARIOUS DIAMETERS

Process bars of random lengths with the Sesco bar feed and cutoff. The unit, with minor changes, will also process bars of various diameters. Bars from 1" to 2" dia are handled, and the cutoff cuts parts within close tolerances from a machine finished bar.



Pushbutton control automatically feeds one bar from the storage rack to the bar loading rolls. The loading rolls then carry the bar forward through the feed, and to the bar cutoff gage, engaging the stock retainer, cycling the cutoff unit, cutting the bar lead, and disposing of the scrap automatically.

The cutoff unit cycles the hydraulic bar feeder. When the trailing end of the bar passes a predetermined point, a signal to the bar storage rack starts another bar to the loading rolls, which carry it to the ready position. The trailing edge of the outgoing bar signals the feed and cutoff units to stop the automatic cycle. The new bar progresses to the cutoff gage, and then the cycle is renewed automatically. The primary feeding unit also can be attached to other cutoff machines.

The bar is fed by a gripper cross head which is reciprocated by means of an adjustable stroke, hydraulic cylinder. The stroke can be infinitely adjusted to the exact stroke length desired, and is cushioned to a positive stop, on both the forward and return stroke. Sesco Inc., 8881 Central Ave., Detroit 4, or —

Circle Inform-A-Gram No. D1.

IF YOU DESIRE ADDITIONAL INFORMATION REGARDING ADVERTISED PRODUCTS OR EDITORIAL ARTICLES USE THE INFORM-A-GRAM CARD ON PAGE 170.1

After thorough research, development and tests . . .

The very first in its field!

NewMet*

by NEWCOMER

Neither a ceramic... nor a tungsten carbide... but an all-new high-velocity metallic cutting material

△ □ ○ NewMet by Newcomer has opened a new field of high velocity cutting in metal-working. A product of Newcomer research and development over the past ten years, this new material is capable of cutting performances beyond the capacities of present machines. Its extreme hardness (Rockwell "A" 95), combined with a comparatively high strength, gives NewMet the ability to perform superbly at both normal carbide cutting speeds or at speeds within the range of ceramic-type cutting tools.

Typical NewMet* PERFORMANCE DATA

1 Turning Low Carbon Steel			2 Turning Medium Carbon Steel			3 Turning Stainless Steel (Magnetic Type)		
SPEED	DEPTH OF CUT	FEED	SPEED	DEPTH OF CUT	FEED	SPEED	DEPTH OF CUT	FEED
1000 to 1500 SFPM	.001" to .090"	.001" to .012"	900 to 1200 SFPM	.001" to .090"	.001" to .012"	800 to 1500 SFPM	Up to .100"	.007" to .010"

Economize now with high-velocity cutting . . . use *"Years Ahead"*

NewMet* by NEWCOMER

NewMet is available in "Throway" triangular, square and round inserts, and solid cylinders. Call your nearest Newcomer representative for complete data, or contact

*Pat. App. for.

NP DISTINCTIVE QUALITY CARBIDE

NEWCOMER PRODUCTS, Inc.

LATROBE, PA.

General Sales Office: 512 Franklin Ave. Pittsburgh 21, Pa.

Call: CHurchill 1-4060

Sales Offices are located in principal cities

CIRCLE INFORM-A-GRAM KEY NO. 143

MANUFACTURING MEMOS

Porter Acquires . . .

• H. K. Porter Co. Inc has made known the acquisition of the Cleveland Hardware and Forging Co., manufacturers of drop forgings, automotive and commercial hardware, and die castings. The 76-year old firm will be known as the Cleveland Division of the H. K. Porter Co. Inc.

Enters Plastics Field . . .

• Minneapolis-Honeywell Regulator Co. enters the field of plastics production. The company has begun full-scale production of epoxy casting and potting compounds designed for use in the electronics industry.

Institute Formed . . .

• A group of engineers representing some leading solid carbide tool manufacturers met recently to form the Solid Carbide Tool Institute. The establishment of uniform physical standards, nomenclature, and marking for solid carbide cutting tools are the objectives of the institute.

Becomes Committeeman . . .

• Col. Willard F. Rockwell, board chairman of Rockwell Mfg. Co. and Rockwell Spring and Axle Co., has been appointed to the National Defense Committee of the U. S. Chamber of Commerce for a term of one year. He will help in the formation of Chamber policies to meet problems affecting national defense.

Purchase Agreement . . .

• The DeVilbiss Co. has announced an agreement to purchase the Newcomb-Detroit Co., manufacturers of custom-built industrial finishing equipment. DeVilbiss acquires additional manufacturing and research facilities, and specialized sales and engineering staffs.

Awards Given . . .

• Four engineers have been elevated to the rank of Fellow of the American Society of Mechanical Engineers. They are Myron R. Bowerman, director of research for the Alliance Machine Co.; Irvin H. Fullmer of the National Bureau of Standards; Rawleigh Johnson of the Ingersoll-Rand Co.; and John A. Worthington, manager, Koppers Co.

• The National Management Association awarded Adriano Olivetti, Italian typewriter and office machine manufacturer and anti-communist industrial leader, the Edward O. Seits Memorial Award for international management according to free enterprise principles. General Hermon F. Safford, president of Ohio Rubber Co., was the association's National Management Man Award winner for leadership contributions to management unity.

The Hydraulic Press Mfg. Co., a division of Koehring Co., has acquired the Henry & Wright Division of Emhart Mfg. Co. Henry & Wright will operate as a department of H.P.M. and will enable Hydraulic Press to enter the mechanical press field.

◆

The consolidation of Reliance Electric & Engineering Co. and Master Electric Co., has been announced. The products and markets of both companies will provide an opportunity for diversification.

◆

The move to Tulsa from Chicago of the Magnecord Division of Midwestern Instruments, Inc., has been revealed. The service and repair functions of Magnecord are now in operation in Tulsa, and most of the personnel are being moved to the new location.

◆

Allmetal Screw Products Co. Inc., has opened their new Midwest division headquarters in Chicago.

◆

The Drop Forging Association is moving from Lansing, Mich., to quarters in the new Illuminating Building in Cleveland, where they will occupy 1,786 sq ft of office space and conference rooms.

◆

The Southern regional warehouse and office of the Latrobe Steel Co., has been opened in Hialeah, Fla.

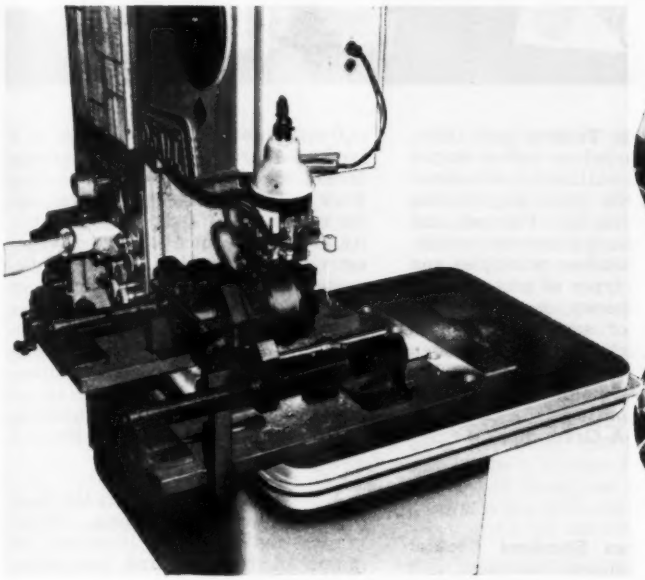
◆

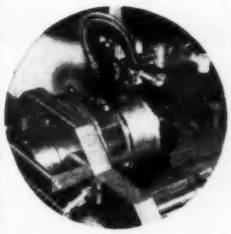
The American Society for Testing Materials Award of Merit was presented to John W. Bolton, retired director of metallurgical research and testing of the Lunkenheimer Co. This award recognizes individuals who have rendered distinguished service to the Society, especially along technical lines.

◆

The announcement of the formation of a new graphic systems group within Burroughs Corp., comprised of three subsidiaries, has been made. The group includes the Todd Co. Inc., Mittag & Voger, Inc., and Acme Carbon and Ribbon Co., Ltd. The appointment of George L. Todd, vice president and director, as vice president and group executive was also announced.

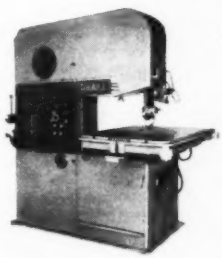
How DoALL Production Band Machining REDUCES SPLITTING COSTS





APPLICATION:
Splitting bearings for diesel locomotives:
Operator places bearing in fixture, presses control button of hydraulic power feed table which moves bearing quickly and accurately into the *high-speed steel* saw band. The job completed in half the time required by previous methods and at lower tool cost.

LOWER FIXTURING COST
Fixturing is simplified because the downward thrust of the saw band forces workpiece against table—eliminating costly work hold fixtures. Often, a simple back-up bar is all that's needed.



New DoALL *Contour-matic* —4 models
Standard machine with hydraulic power feed table, infinitely variable blade speed, built-in coolant system, high horsepower, plus great rigidity and precision for smooth accurate operation.

DoALL DEMON *high speed steel* BLADES
Demon high-speed steel saw bands withstand cutting temperatures up to 1100° without losing tooth hardness . . . and last up to 30 times longer than carbon steel blades!

FREE DEMONSTRATION

Call your DoALL Store today for a free "in-your-plant" demonstration of this new basic machine tool. Or, send for free catalog.

DoALL Contour-matic . . . Industry's Newest Production Line Machine Tool

This new "integrated" combination of blade and band machine offers you BIG SAVINGS in *time*, *labor* and *materials* for production line splitting operations. . .

1—HIGH SPEED STEEL SAW BAND—splits parts faster! Continuous-cutting Demon HSS blade "slices" right through any machineable metal many times faster than obsolete "chip-by-chip" methods! Extremely high cutting accuracy reduces rejects and material waste! And, long blade life reduces tool costs!

2—CONTOUR-MATIC BAND MACHINE—automatically feeds workpieces! Automatic power feed table enables operator to turn out *more* parts in *less* time than previous methods! Simplified fixturing and easy setups reduce time and labor costs! Substantially lower machine investment compared to slower, less versatile machine tools means you save money right from the start!

Find out today how DoALL band machining can reduce costs and modernize your parts splitting operations!

THE DoALL COMPANY— Des Plaines, Ill.

Find Your DoALL Store In The 'Yellow Pages'

ASK ABOUT FREE FIXTURING SERVICE
—Preliminary sketches and recommendations for DoALL band machine fixturing will be provided at no cost to you.

"Visit our Booth No. 360, Metals Show, Chicago, Nov. 4-8"

B-48

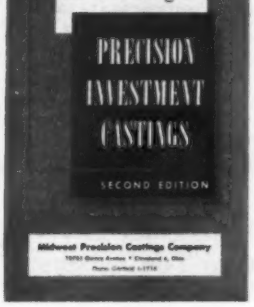
THIS IS A TYPICAL DoALL STORE

Call Your DoALL Service-Store

CIRCLE INFORM-A-GRAM KEY NO. 145

SHOP

"How To Design Precision Investment Castings" has been expanded and contains new process information and case histories. In addition to a description of the process, the booklet discusses in detail many basic design principles as they apply



to the investment casting process. A materials chart listing physical properties and uses of some metals is also included. Copies of the booklet are published by Midwest Precision Castings Co., 10703 Quincy Ave., Cleveland 6, or —
Circle Inform-A-Gram No. C1.

A Load Comparison Chart for three series of chrome-vanadium steel die springs is now available from The Producto Machine Co., 990 Houstonic Ave., Bridgeport 1, Conn. This two-color chart has been designed to simplify selection of the die spring that best meets the requirements of a particular application on the basis of load rate, diameter, free length, and percent deflection. It covers the three series of Producto chrome-vandium springs. The chart is supplied by the company, or —
Circle Inform-A-Gram No. C2.

A Handbook describes the latest developments in the surface treatment of metals. It covers rust prevention, mechanical and chemical cleaning, blackening, phosphating, and other aspects of the field. Various treatment processes are diagramed. Copies of the booklet are made available by E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, or —
Circle Inform-A-Gram No. C3.

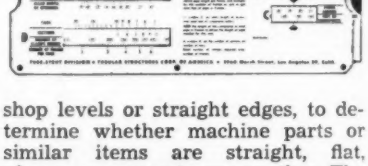
Cold Bending Tubing, pipe, bars, rods and extruded or rolled shapes on machines is outlined in a bulletin published by the Pines Engineering Co., Inc., Aurora, Ill. Pictures and diagrams illustrate a section describing the basic bending principles and models for all types of jobs are discussed. A capacity chart lists the specifications of some of the machines and sections present design features and special models. For your copy of Catalog 356, write to the company, or —
Circle Inform-A-Gram No. C4.

The American Standard Booklet on surface roughness, waviness, and lay shows how to reduce machining costs and control surface finish. It defines geometric irregularities of solid material surfaces and physical specimens for gaging roughness. Definite classifications for roughness, waviness, and lay are established, as well as a set of symbols for drawings, specifications, and reports. To assure a uniform basis for measurement, specifications are also provided for precision reference specimens, and specifications for tracer type instruments. Copies of this bulletin are offered by Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, or
Circle Inform-A-Gram No. C5.

An Explanation of the requirements peculiar to stainless steel finishing and how they are best met is featured in an 18-page catalog on stainless steel finishing operations. The correct approach to actual finishing is presented in the order of the severity of the operations themselves. Included are grinding, sanding, the stain finishes obtained by using string wheels, polishing and buffing, along with detailed information on the techniques to be followed by operators, such as pressures, strokes, speeds, etc. The equipment section lists the recommended equipment for these operations. A useful guide is the section entitled "Some Tips for Better Finishing." "Stainless Steel Finishing" is being distributed by R. G. Haskins Co., 2651 W. Harrison St., Chicago 12, or —
Circle Inform-A-Gram No. C6.

Ductile Iron is the subject of a booklet offered by the International Nickel Co., Inc., 67 Wall St., New York 5. Economy, types available for varied needs, toughness, castability, wear resistance, and other characteristics of ductile iron are discussed. There is also a table which lists the types of iron with reference to typical range of mechanical properties, specifications, characteristics, and applications. Charts and illustrations are included. Write to the company for a copy of the bulletin, or—**Circle Inform-A-Gram No. C7.**

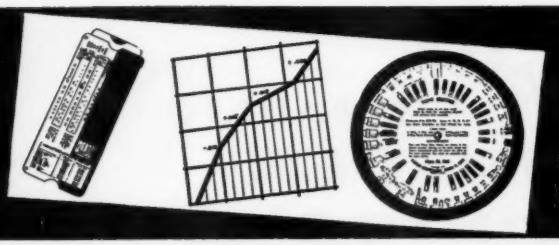
A 56-Page Manual covers the basic principles of optical tooling. Photographs and drawings illustrate the major instruments and accessories used in optical tooling and optical principles used in applying the equipment. The application of simple optical principles permits tolerances as close as 0.0001" to be held at distances from a few inches to as much as a mile. This method saves time in contrast to older methods for holding accuracy, such as taut wires,



shop levels or straight edges, to determine whether machine parts or similar items are straight, flat, plump, or square to one another. The Optical Tooling Manual is available from Keuffel & Esser Co., 260 Madison Ave., New York 16, or —
Circle Inform-A-Gram No. C8.

Save Time and Money using the Tube-Strut Clamp for bracing in storage rack construction. This is one advantage of these clamps outlined in a bulletin. Only one clamp is needed for the positions for bracing with 2, 3, 4, or a diagonal brace. Tube-Strut Clamps are available from ½" to 2" pipe sizes. A rack materials calculator for bar stock and pallet racks is also available. For more information write to Tube-Strut Div'n, Tubular Structures Corp. of America, 2960 Marsh St., Los Angeles 39, or —
Circle Inform-A-Gram No. C9.

AIDS



A Bulletin on the Technical Aspects of Molybdenum Disulfide as an extreme pressure lubricant is "Breaking Lubrication Barriers." It covers the physical and technical properties of the compound. In addition, charts are provided on its lubricity. Featured in the bulletin are a catalog-type selection table and a section on bonded solid film lubricating coatings. Also presented in the bulletin is the history and development of the Molykote line of molybdenum disulfide lubricants. Copies of Bulletin 110 can be obtained by writing to The Alpha Molykote Corp., 65 Harvard Ave., Stamford, Conn., or —
Circle Inform-A-Gram No. C10.

Technical Data on heat resistant castings is available from Alloy Casting Institute. A feature of the data sheets is a listing of room temperature and elevated temperature properties of each of the cast heat resistant alloy grades. In addition to specific property data, each of the 14 sheets gives a concise discussion of the applications, design, and fabrication characteristics of each alloy. Metallurgical structure and characteristics of each alloy are completely described. Copies of the technical data may be obtained from Alloy Casting Institute, 286 Old Country Rd., Mineola, N. Y., or —
Circle Inform-A-Gram No. C11.

"Hastelloy Corrosion-Resistant Alloys" gives information on four nickel-base alloys — Hastelloy Alloys B, C, D, and F. Described are their chemical compositions; and physical, mechanical, and high-temperature properties. Also included is a table of the comparative resistance of the alloys to over 250 corrosives. This information is supplemented with graphs showing penetration rates at various acid concentrations and temperatures. A separate section covers techniques for forging, cold working, machining, grinding, and welding of the alloys. Contact the Advertising Dept., Haynes Stellite Co., Div'n of Union Carbide Corp., 420 Lexington Ave., New York 17, or —
Circle Inform-A-Gram No. C12.

The Report on the Second Annual Contour Machining Conference is being offered by True-Trace Corp., 9830 E. Rush St., El Monte, Calif. Included in the report are speeches, panel discussions, and question-answer sessions which deal with contour and profile machining methods. Air frame and general metal cutting problems and their solutions comprise a major part of the report.
Circle Inform-A-Gram No. C13.

The Various Methods of bending pipe and tubing and supplies is described in a 6-page folder. In the section of machines and methods, diagrams are included of the various ways to do the bending job. It also

discusses the different types of alloy steels used in the pipe and tubing. For your copy of Bulletin TDC 187 contact The Babcock & Wilcox Co., Tubular Products Div'n, Beaver Falls, Pa., or —
Circle Inform-A-Gram No. C14.

An 8-Page Brochure discusses means of eliminating cracking hazards in the manufacture of tools and dies. The booklet gives detailed information on design, how to make the tool, heat treatments, and selecting the steel. Illustrations show tools and dies having cracks of various kinds, and the causes are explained along with recommended ways to avoid the cracks. For your copy, write to The Carpenter Steel Co., 306 W. Bern St., Reading, Pa., or —
Circle Inform-A-Gram No. C15.

Case Histories of Marking Machine Installations are illustrated and described in Catalog 14 published by George T. Schmidt, Inc. The catalog presents stories of how manufacturers in many fields are using marking equipment to their advantage. It also outlines examples of installations in customers' plants, to solve various cost or production problems. Obtain your copy of the catalog from the George T. Schmidt, Inc., 4112 N. Ravenswood Ave., Chicago 13, or —
Circle Inform-A-Gram No. C16.

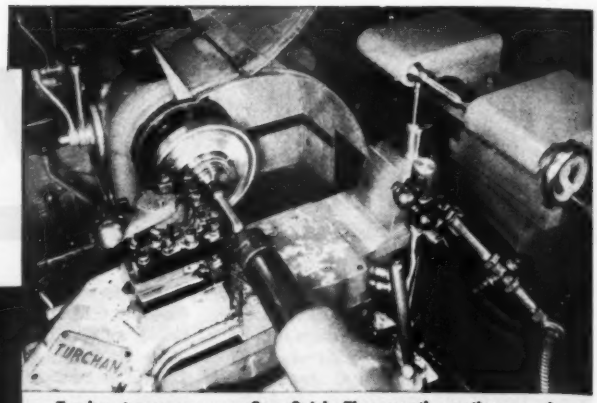
A Pocket-Sized Reference Booklet contains information on commercial tolerances for welded steel tubing and other data of interest and use to engineers and designers. Included in the booklet are 14 pages of easy to read tolerance charts for cold rolled steel, hot rolled steel, cut lengths, rounds, squares, and rectangulars and Revere propeller shaft tubing. For your copy write to Revere Copper and Brass Inc., Rome Mfg. Co. Div'n, P.O. Box 111, Rome, N. Y., or
Circle Inform-A-Gram No. C17.

Find Out How to Machine Enduro Stainless Steel Bars by consulting a handbook released by Republic Steel Corp., Advertising Div'n, 3100 E. 45th St., Cleveland 27. It covers machinability, hourly production, drills, stock requirement, machining Enduro, and correcting difficulties. In addition, the booklet gives decimal equivalents, rpm and sfm, screw thread standards, and tolerances and sizes. Other sections present wire gages, quality control tables, types of Enduro, Enduro specifications, and cold finished products.
Circle Inform-A-Gram No. C18.

An Engineering Report describes the controlled addition of copper to the chemistry of Stressproof steel bars. It outlines the development of the chemistry, the heavy drafting practice, furnace treatment, and die practice which affect the quality and properties of the steel. The improved machinability of the steel is one of the advantages pointed out in the report. For more information about the steel, write to La Salle Steel Co., P. O. Box 6800-A, Chicago 80, or —
Circle Inform-A-Gram No. C19.

Turchan HYDRAULIC TRACER CONTROLS

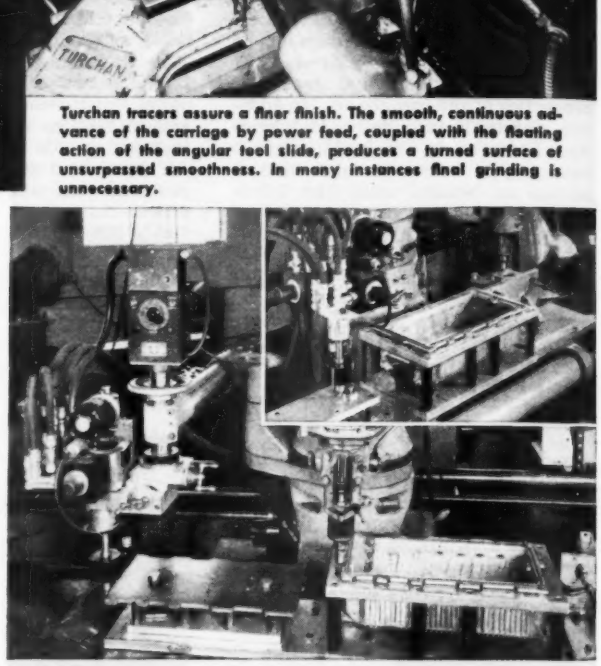
THE SIMPLEST SYSTEM OF MORE PROFITABLE PRODUCTION



Turchan tracers assure a finer finish. The smooth, continuous advance of the carriage by power feed, coupled with the floating action of the angular tool slide, produces a turned surface of unsurpassed smoothness. In many instances final grinding is unnecessary.

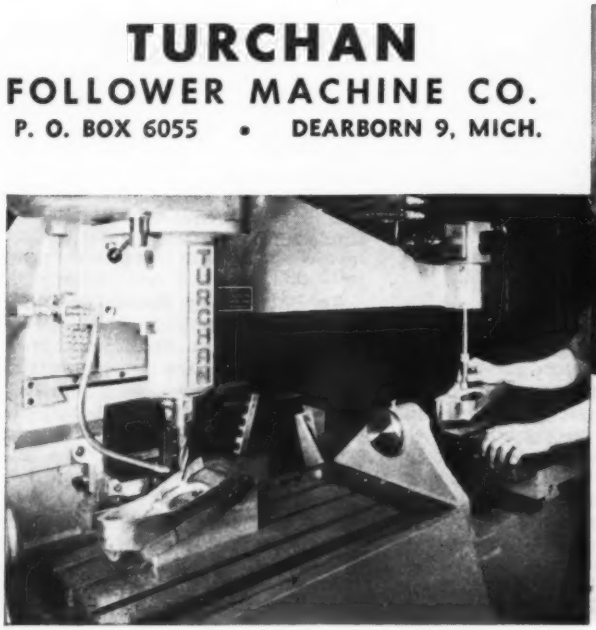
TURNING
MILLING
BORING
PLANING
SHAPING

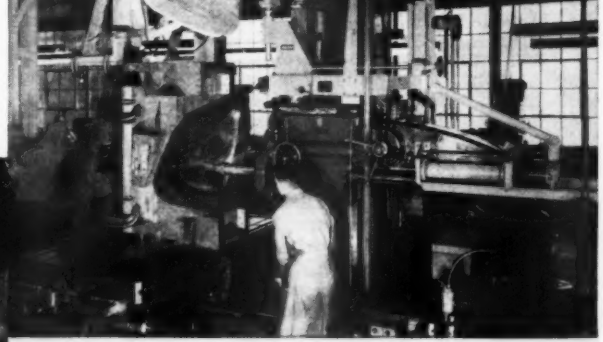
Machine tools equipped with Turchan tracer controls handle a greater variety of work faster and more accurately. Standard operation of the machine is possible by a simple switching mechanism which converts the machine quickly from straight work to intricate profiling and contouring and back again.



Complicated work requiring contouring, grooving and profiling are handled easily with Turchan Tracer control. In most cases many extra operations are reduced to one set-up.

TURCHAN
FOLLOWER MACHINE CO.
P. O. BOX 6055 • DEARBORN 9, MICH.





Turchan units are supplied complete. Installation is very simple and all installations are supervised by a Turchan engineer.

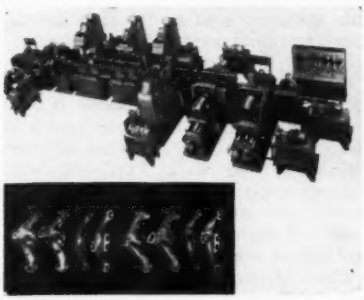
Write today for your Turchan Folders. If you have a production problem Turchan has the solution.

TWO TRANSFER MACHINES FOR AUTOMOTIVE EXHAUST MANIFOLDS

Two comparable special machines have been brought to our attention. We present data given by the respective manufacturers and do not propose to direct the reader's engineering comparisons.

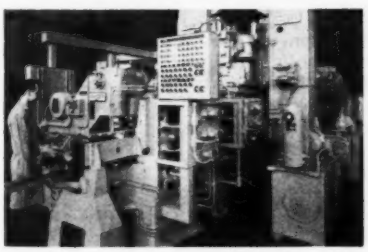
The 20-station Buhr Economatic, Figure 1, completely mills and machines both right-hand and left-hand exhaust manifolds in one machine.

A feature is its swift "Bi-Part Accommodation", the facility of quick change-over from right-hand to left-hand parts (or vice versa), which is accomplished by gyrating spindleheads.



Process includes the following 41 operations — (15) drill, (8) spotface, (5) mill, (5) countersink, (4) tap, (2) ream, (1) counterbore, and (1) probe.

Other features include: load stations designed to replace a casting-qualifying gage, automatic probe and blow-out before tapping, special Buhr sectional-base construction to facilitate future part-changes, standard and special parts interchangeable for ease of maintenance, spindles arranged for pre-setting of cutting tools, hardened and ground steel ways, central mist-lubrication on all heads, individual pushbutton stations on all units, emergency stop above all stations, J.I.C. Standards throughout, automatic lubrication fault-detector, and automatic lubrication of all moving parts.



The Snyder special machine tool mills, drills, chamfers, and taps two different automotive engine exhaust manifolds. Built-in sensing devices in the 28-station, 63' automated machine, Figure 2, permit two different

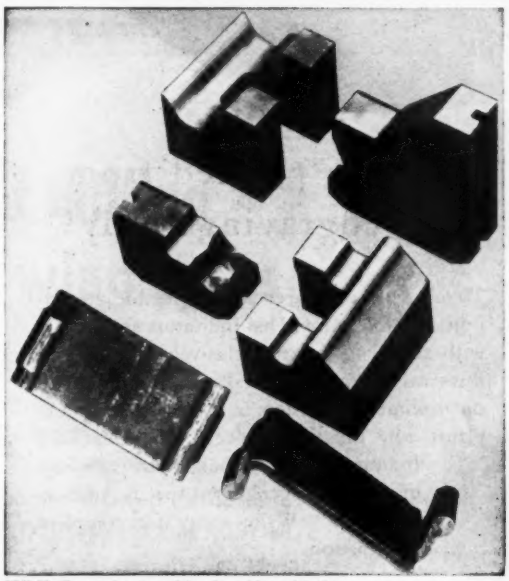
. . . Continued on page 150

50% to...???

INCREASED PRODUCTION, PROVEN WITH . . .

Darwin **PRK·33 TOOL STEEL**

For the extra performance and savings you want from better wearing tools and dies — less downtime for retooling or regrinding and longer, more economical runs — it's not the first cost, but the "plus" of Darwin PRK-33 that counts. The unique composition of added Cobalt, Chromium, Nickel, Manganese and Molybdenum give PRK-33 both stainless and non-corrosive qualities — plus, rigorous durability. If you are now using standard 150 carbon, air hardening high chrome tool steel, it will pay you to call or write today about the savings you can effect with PRK-33!



PRK-33 dies and automobile door hinge blanks. Stock 3/8" thick, H. R 1020

REPORTED BY PRK-33 USERS

HOT COINING DIES — Increased production from previous high of 7,000 pieces to 16,100 (130% increase) without sign of heat or wear cracks.

KNURLING TOOLS — Beats not only High Carbon—High Chrome but also High Speed Steels in many cases. One case reports 50% better than High Speed Steels.

DRAWING DIES — Philadelphia concern did over 60,000 pieces per grind, against previous best record of 16,000.

Complete line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Forgings, and Sand Castings, Drill Rod, Flat Ground Stock and Tool Bits. Bulletin on Request.

DARWIN & MILNER Inc.

highest grade tool steels

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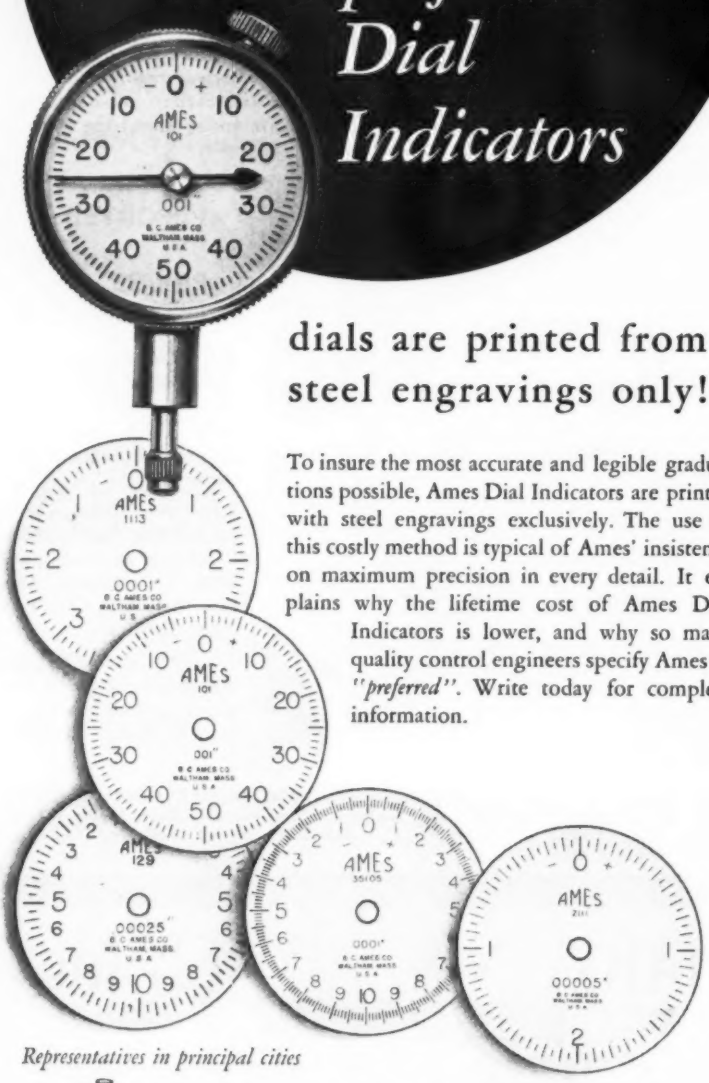
ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

CIRCLE INFORM-A-GRAM KEY NO. 149

AMES

...the preferred Dial Indicators



dials are printed from steel engravings only!

To insure the most accurate and legible graduations possible, Ames Dial Indicators are printed with steel engravings exclusively. The use of this costly method is typical of Ames' insistence on maximum precision in every detail. It explains why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as *"preferred"*. Write today for complete information.

Representatives in principal cities

B.C. AMES CO.

23 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS
CIRCLE INFORM-A-GRAM KEY NO. 150

. . . Machines from page 149

manifolds to be processed through the operations at random.

The joint faces of the two manifolds are identical, and the milling, drilling, and tapping operations are performed on them first. The additional clamping support required for one of the manifolds is provided at these stations by sensing devices that detect a cast surface and cause a hydraulically-operated clamp to engage the part.

Latter operations are performed after the manifolds are automatically turned over by a rotating fixture. The subsequent operations are not common to both parts. Part "A" is processed through these operations and passes through the balance of the machine with the stations idled by the sensing devices. Part "B" has idle stations through the first operations and is processed in the last stations.

Four probing stations are provided that shut down the machines if any incomplete holes or broken taps are detected. Machining units are Snyder standard type with hardened and ground ways. Seven way-type units and eight self-contained units are used. Tapping head spindles have individual lead screw drives.

Control panels are Snyder Circuit Sleuth designs. The machine is hydraulically-operated and electrically-controlled throughout. Separate hydraulic pump and tank units provide power for the standard way-type machining units. Each machine segment has its own individual control panel, and automatic lubrication is provided for all moving parts.

COLD FORMED STEEL BLANKS APPROXIMATE FINISHED PART

Savings up to one ton in every three in the mass production of multi-diameter machine shafts are possible with a new method of cold reducing hot rolled steel bars.

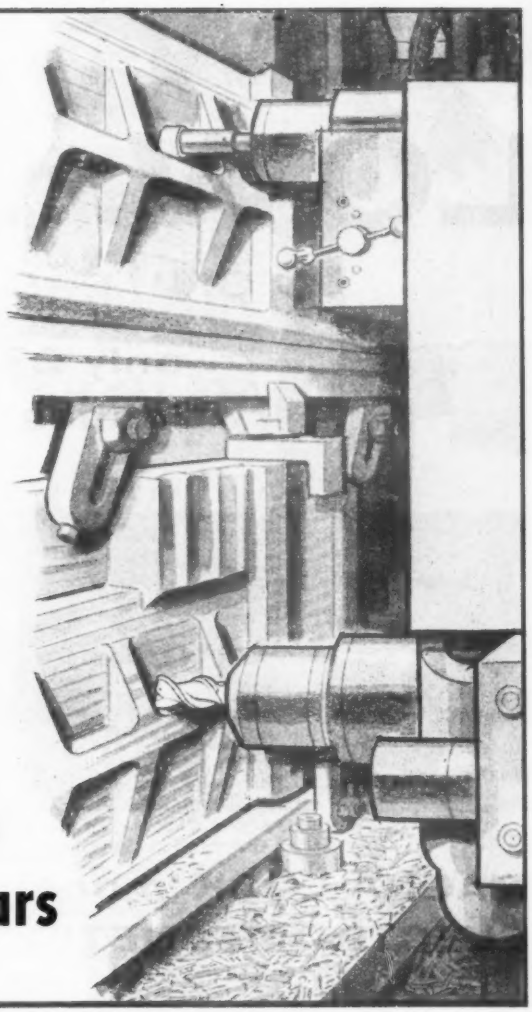
The process at the Bolt & Chain Division of Republic Steel, called "Republic Die-Form", produces carbon, alloy, or stainless steel blanks which closely outline the shape and size of the finished part. A finishing cut and/or grinding is all that is required.

"Republic Die-Form" pieces can be used in place of conventional bar stock in sizes up to 42" in length and 2" in diameter. It permits major savings in time, steel, and money in mass produced, multi-diameter machine shafts when used in minimum orders of 20,000 lbs.

Principle of the process involves pushing dies over the die form blank

. . . Continued on page 152

CLEVELAND
Hy-Spiral End Mills



cut the cost of milling 75 ST aluminum wing spars

CLEVELAND Hy-Spiral End Mills have increased production from 12 to 37½ spars per grind. They have eliminated tool breakage, and have greatly reduced the build-up on side and end cutting edges. ◈ CLEVELAND Hy-Spiral End Mills were developed primarily for aircraft forging tracer milling. They have the right combination of rake, relief and helix angles to provide the proper shear cutting action for fine finishes and long tool life in non-ferrous materials. They also give excellent results in many ferrous applications. ◈ For full information about these *high performance* end mills, contact our nearest Stockroom, or . . .

Request your copy of this helpful, informative book that describes the complete line of CLEVELAND End Mills

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Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58 • E. P. Barrus, Ltd. London W. 3, England

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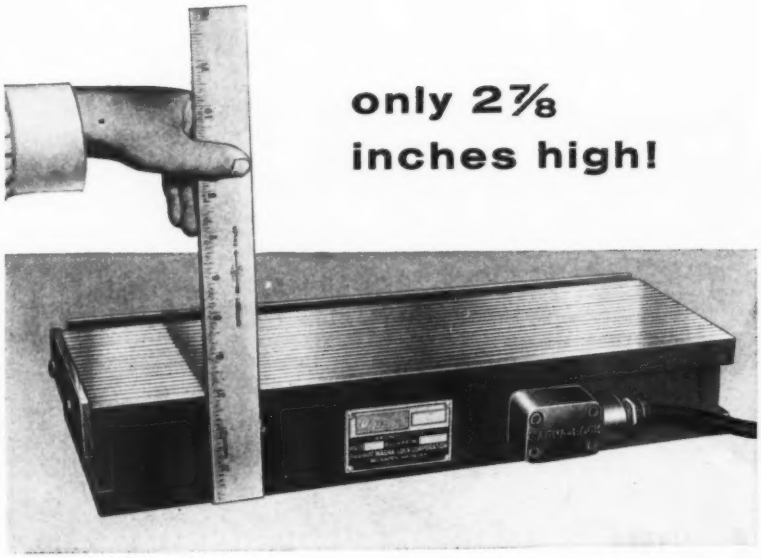
NEW... LOW...



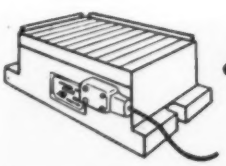
MAGNA-LOCK model L ELECTROMAGNETIC CHUCKS

7 SIZES TO CHOOSE FROM . . .

5" x 10"
6" x 12"
6" x 18"
8" x 18"
8" x 24"
10" x 15"
10" x 16"

Now you can have more working height under the grinding wheel and still get the advantages of Magna-Lock fine pole laminated top construction — 22% more holding area than other types — work pieces held securely even at extreme edges of top plate.

These new chucks feature famous Magna-Lock holding power and rugged, all-steel, welded, precision construction. They'll bring new cost cutting versatility to your tool room and your production machining operations. It will pay you to investigate these new Magna-Lock Model L chucks. *Do it today!* Write Dept. TP 107.



Hanchett **MAGNA-LOCK CORPORATION**
BIG RAPIDS, MICHIGAN, U. S. A.
designers and makers of a complete line of magnetic chucks and devices.

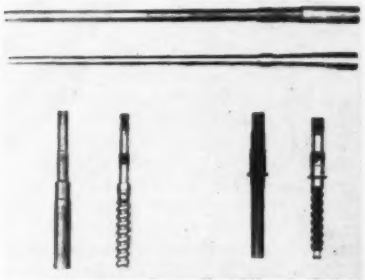
CIRCLE INFORM-A-GRAM KEY NO. 152

. . . Formed Steel from page 150

from opposite ends to the desired distance and stripping them off again. Operation is repeated on either or both ends if further reductions are required.

Much greater reduction can be taken by pushing in this manner rather than pulling as in the case of cold drawing long bars.

Applicable to many parts produced by industry, the method was initially applied to transmission shaft blanks produced for an automotive company. At that time, the idea was not necessarily to reduce cost, but to conserve steel when the automotive company was limited by allotment. By this means 200 tons of hot rolled bars were made to produce the equivalent of 300 tons of cold drawn bar stock.

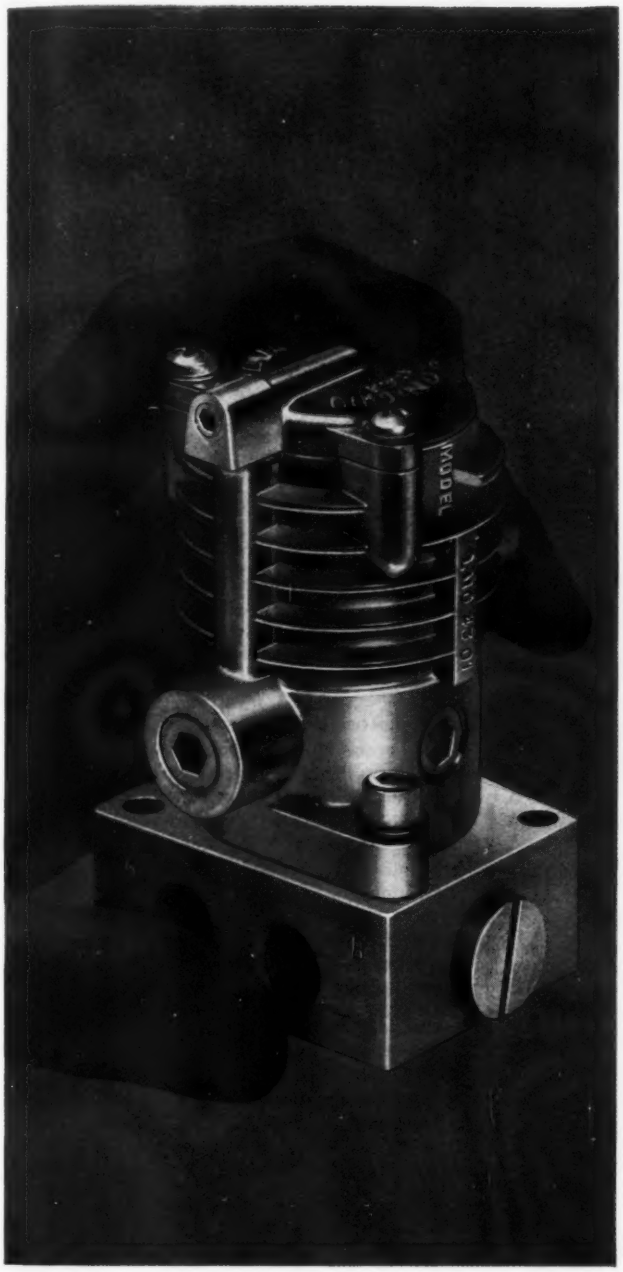


Uses for this type of bar stock have extended through the automotive field to farm equipment, applicances, and electric motors. In producing a rifle barrel blank for a gun manufacturer, 45% of the steel formerly required was eliminated. The producer of the final part may by this system decrease his machining time by decreasing the amount of material he has to remove. In addition, cost may be further reduced through decreased capital investment in machine tools and elimination of excess weight-handling costs in raw material and scrap disposal.

In some cases the physical properties of the steel used in the cold working process are improved to a greater extent than that of ordinary cold drawing. The machinability of the bar is improved; in some cases it does away with the need of using resulphurized steel.

The process holds diameters to within 0.005", and lengths of the shoulders or step-downs are held to within 0.0625". Straightness in some cases can be held to 0.005".

SEE YOUR PAYROLL DEPT. FOR INFORMATION ABOUT U. S. SAVINGS BONDS



something to crow about . . .

VALVAIR'S NEW BANTAM 4-WAY VALVE!

compact . . . versatile . . . economical . . .

Here it is . . . the miniaturized 4-way valve you've needed for control of small double-acting cylinders and similar devices!

Valvair's BANTAM is remarkably compact . . . a mere 4 inches high . . . 30 ounces light! And, it's lightning fast, too. Valvair ingenuity provides 4-way action with a standard Speed King pilot and a pressure-balanced shuttle in the anodized aluminum lower body. Pilot plunger, spring and shuttle—all stainless steel—are the only moving parts. Here's both performance and *built-in multi-million cycle dependability!*

Pilots built to JIC standards . . . 2 point mounting . 15-140 psi pressure range . . . ¼ in. NPT ports . . . solenoid coils for ac or dc, any voltage . optional integral junction box and manual over-ride . . . Valvair's BANTAM offers them all! For better performance—at lower cost—put this mighty midget to work on your equipment—soon! Valvair Corporation, 454 Morgan Ave., Akron 11, Ohio. AA-5249

$21.75 list price—basic valve

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Compare . . . and you'll buy

Valvair

- **small size—4 inches high**
- **fast response—bubble-tight sealing**
- **single solenoid—only 3 moving parts**
- **corrosion-resistant materials—solenoid coil guaranteed against burn-out for life of valve**
- **pilot interchangeable with Speed Kings**
- **immediate delivery from stock**

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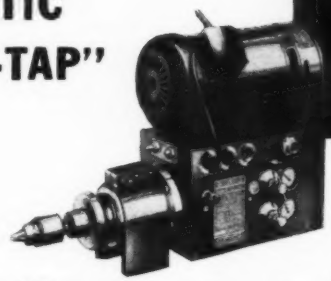
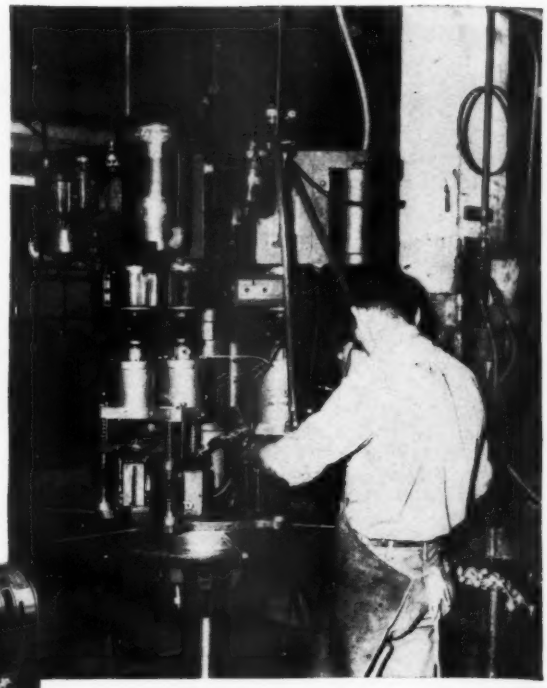
CIRCLE INFORM-A-GRAM KEY NO. 153

Here's How A Mower Manufacturer . . .

drills, taps, spotfaces 400% FASTER

with DUMORE series 28 AUTOMATIC "DRILL-N-TAP" UNITS





JACOBSEN MFG. CO. combines readily available Standard Dumore Components with simple fixturing and indexing to quickly build this special-purpose machine for faster, lower cost production on brass connecting rods.

5 Dumore "Drill-N-Tap" Units, mounted on a Dumore Drill Press Stand, serve as driving heads. Two holes are drilled, then spotfaced using the multiple head. An angle hole, then a center hole are drilled. Next, two holes are tapped on the multiple head. A simple hand indexing ring moves the set-up to each station. Previous methods produced only 75 pieces per hour with one man using three different machines in sequence. Now, one man produces 350 pieces per hour — nearly 400% faster!

In addition, Jacobsen can use these Dumore Units for other work. They are merely detached, by the simple nose mounting devices, and carried to new set-ups . . . storing the original set-up until needed again.

THE DUMORE SERIES 28 "DRILL-N-TAP" UNIT drills or taps at the flip of a switch. Tap fits into chuck, no extra head required. Reversing motor removes tap, eliminates expensive clutches. Spindle speeds 265 to 4900 rpm. For long or short runs. Mounts in 3 minutes — anywhere, with simple nose bracket. Available as complete Drilling and Tapping Press with fixture, press and "Drill-N-Tap" Unit, or, "Drill-N-Tap" Unit supplied with bracket to convert your 14" x 17" drill press into a completely automatic drilling and tapping machine.

YOU CAN SAVE HUNDREDS OF DOLLARS IN FIRST COST ALONE WITH THESE DUMORE AUTOMATIC DRILL UNITS . . . *Series 24* — Fully automatic with all controls built-in. Preselected speeds, feeds, depth. Ideal for varying runs and frequent change-overs . . . *Series 26* — Same as Series 24 with just *basic* controls for long, uninterrupted runs.

Get A Demonstration Now . . . See Your Distributor, or Write

DUMORE PRECISION TOOLS

AUTOMATIC DRILL and TAP UNITS
PORTABLE MILLING UNITS
MICRO-DRILLS
TOOL POST and HAND GRINDERS

Made by the makers of the *famous, universally used* DUMORE TOOL POST GRINDER

THE DUMORE COMPANY • 1304 - Seventeenth Street • Racine, Wisconsin

DUMORE DRILL GRINDER SERIES 21

For fast, accurate sharpening of all 2-lip twist drills (including crankshaft) from No. 70 to ¼". Grinds included angles from 90° to 150°, clearance angles from 5° to 15°. Cuts volume drill costs.

DUMORE AUTOMATIC DRILL HEADS SERIES 20

For high production drilling of small parts. Eliminates drill breakage. Automatic built-in controls. No. 80 to 5/32" capacity.

DUMORE MICRO-DRILLS SERIES 27

Drills small holes to .001" without specialty trained operators. Super-sensitive feed. Accurate and instant-centering magnetic chuck. Micrometer depth control. Speed control box. Two models.

DUMORE DRILL PRESS STANDS

Circular or rectangular table fixture press. Includes base, column, table, 2 clamps and bracket. Use with Dumore Units for versatile, automatic machining.

AND BRACKETS

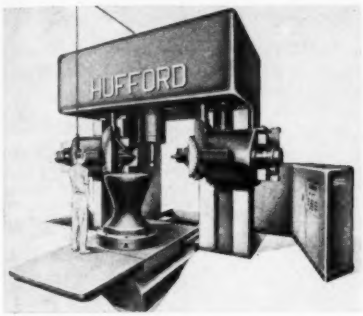
Provide mounting for Dumore Units on your 14" x 17" drill press stands.

FOR MORE INFORMATION ON THESE PRECISION TOOLS—WRITE FOR CATALOG

COLD FORGING FORMED ON NEW SPIN TYPE MACHINE

A new concept in machine design combining the features of a vertical spinning lathe with a process for forging the wall thickness of sheet parts has been announced.

The machine built by the Hufford Corporation and known as the Spin-Forge enables forming of parabolic, hemispherical, conical, hour-glass, and other shapes from one workpiece. In addition, it provides facilities for forging the metal, varying the wall thickness starting from a full inch and reducing this to as little as a few thousandths.



Force used for spinning and forging is applied by two hydraulically actuated and opposed rollers. The rollers feed vertically down the form, longitudinally into die contours and, being mounted on angular-tilting heads, can follow all contours maintaining a right angle contact with the work surface. Travel of the rollers in all directions is tracer controlled, which follow templates automatically. Each roller works independent of the other in any of its several motions.

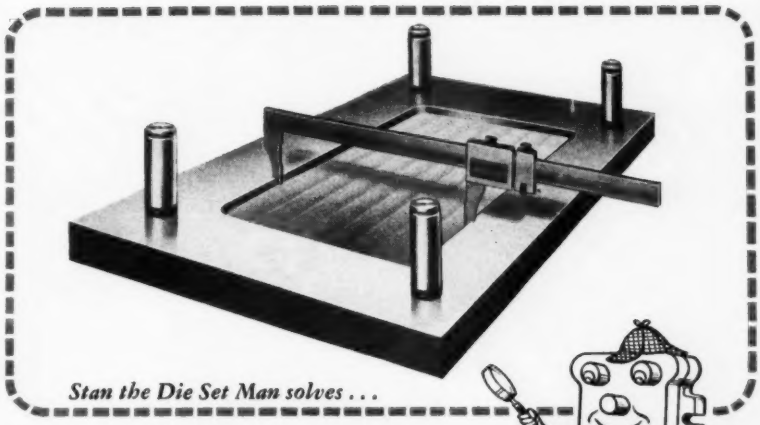
The die, contoured to the shape of the finished part is mounted on a rotating table having spindle speeds up to 400 rpm. The entire table and spindle assembly is carried on a slide which can be moved outwardly from the forming position. This simplifies loading and removal of parts without overhead barriers and reduces overall height requirements of the machine.

Power for the spindle drive is furnished by a 200-hp motor. A 225,000-lb forming force is supplied to each roll by hydraulic cylinders operating 3,000 psi. Feed rate is 60 ipm.

For operator safety the system includes a Closed TV circuit with two Hallamore cameras and screens for close-up vision from a remote location. Other circuits provide for programming the forming operations for automatic duplication of parts.

Two basic machine types are indicated by present requirements. The original machine will handle a 60"

. . . *Continued on page 157*



Stan the Die Set Man solves . . .

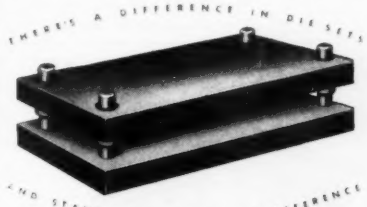
THE
CRAZY CASE
OF THE
DRIFTING DIMENSIONS

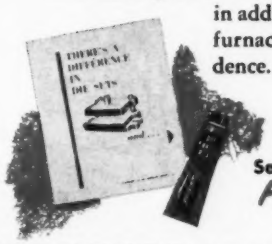
CASE HISTORY: Expert diemaker accurately mills pocket in which to mount blanking die. Next morning, finds die does not fit pocket. Rechecks pocket with vernier calipers and finds dimensions have mysteriously drifted! Finds, too, that posts bind in bushings when he tries to reassemble die set. Result: diemaker almost loses mind . . . loses time and money, too!

SOLUTION: Diemaker calls Standard Die Set Engineer. (Smart move!) Learns that instability of steel in ordinary die sets often results in drifting dimensions. Learns, too, that Standard gets around this problem by *stress relieving* all punch and die holders. Meaning they are slowly heated to 1550° F. . . . soaked at this temperature for 3 hours . . . then gradually cooled to room temperature. This removes residual stresses . . . assures that dimensions "stay put" . . . provides absolute parallelism of working surfaces.

BEST OF ALL, Standard Stress-Relieved Die Sets are yours at prices competitive with ordinary die sets. Worth looking into!

SO HELPFUL is this service to tool and diemakers, Standard has now installed large annealing furnaces in Philadelphia and Indianapolis, in addition to the furnace at Providence.





Send for this Die Set Comparison Chart and *FREE* tube of Standard Diemakers Grease!

MAIL THIS COUPON NOW

STANDARD DIE SET MFRS., INC.
1501 Elmwood Avenue
Providence 7, R. I

☐ Please send comparison chart
☐ Yes, I would like sample tube of grease

Name.....
Company.....
Address.....

New York • Philadelphia • Buffalo • Detroit • Grand Rapids • Indianapolis • Louisville

CIRCLE INFORM-A-GRAM KEY NO. 155

UNI PUNCH

PERFORATING UNITS

C Punching holes in the work with the first stroke of press ram. No aligning of punches and dies. The same group of units may be used in unlimited set-ups for greater economies.

Visit our Booth 1759 at 39th National Metal Exposition, International Amphitheater in Chicago, November 4-8.

WRITE FOR FULLY-ILLUSTRATED CATALOG *TODAY*

PUNCH PRODUCTS *Corporation* 3804 HIGHLAND AVE., NIAGARA FALLS, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 156

. . . Cold Forging from page 155

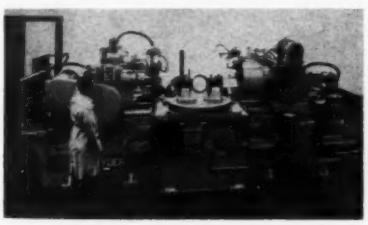
wide by 60" long part. It is designed to work Type 321 stainless steel of 1" thickness, reducing this to ½" in a single pass. Multiple passes can be programmed when greater reduction is necessary. Other plans indicate need for increased size capacity to 120" x 120". This machine will handle the forming of thin walled parts of uniform wall thickness such as tank ends, missile noses, aircraft fuselage components, etc.

SPECIAL MACHINE USES PARTIAL AUTOMATION FOR 40 OPERATIONS

The extent to which partial automation concepts can be carried on special machine tools to economically produce a variety of low-production parts is demonstrated in this line-index type machine.

The new special machine, built by Snyder Tool & Engineering Company, performs up to 40 drilling, boring, turning and tapping operations to complete the machining of three different large tractor drive axle housings. The housings are made of either malleable iron or cast steel. One housing is produced at a net rate of 9.1 pcs/day, the second at 10.2 pcs/day, and the third at a net rate of 8.5 pcs/day.

Flexibility of machine operation for such a variety of operations and parts is provided by mounting the part in a fixture with a built-in index table. This fixture and table unit is indexed in a line through six stations between two pair of opposed wing base machining units. Where required, the fixture is rotated 180° between stations.



The first pair of machining units that operate in stations one and two consist of a two-spindle boring head and an opposite single-spindle cross facing head. The second pair of machining units, portions of which operate in stations four through six, consist of a 31-spindle drill head and an opposite 25-spindle tapping head.

The 40 separate machining operations are accomplished by pushbutton controls that index the fixture back and forth between the stations, rotate the fixture in accordance with a program sheet, and cycle the ma-

. . . Continued on page 158

See how big 3-D views speed assembly, measurement and inspection of tiny parts.

FREE

15-DAY, ON-THE-JOB

TRIAL!

These essential production tools make small-parts manufacture faster and easier, make precision surer. Views are vivid, magnified in natural 3-dimensional detail. Complete line to fit exact model to your specific industrial needs. Dustproof, shockproof, built for rugged production-line use —you can mount them right on machines!

See for yourself! Use a B&L Stereomicroscope on your own job for 15 days—absolutely free, no obligation. All we ask is the opportunity to let our Stereomicroscopes prove themselves to you. Just call your regular B&L dealer, or mail the coupon today.

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☐ Yes, I'd like to borrow a B&L Stereomicroscope for a 15-day trial without cost or obligation.

☐ Send me B&L 3-D Micro-Vision Book, containing valuable data, showing actual stereo views.

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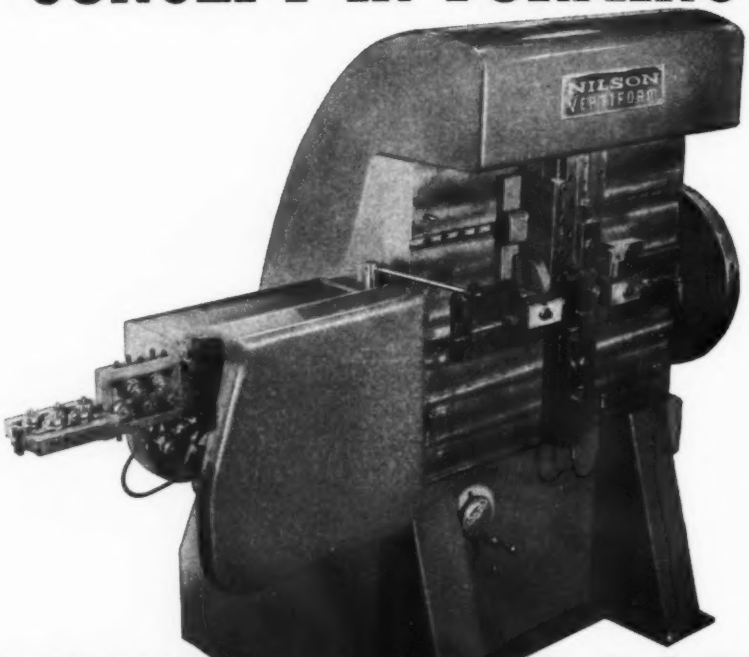
TITLE.....
COMPANY.....
ADDRESS.....
CITY..... ZONE..... STATE.....

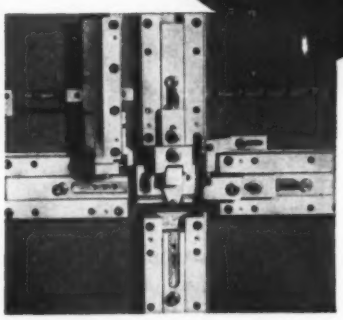
BAUSCH & LOMB
SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 157

NEWEST

CONCEPT IN FORMING





NILSON VERTIFORM

Our LATEST DEVELOPMENT—

Applying 4-Slide Forming Techniques To A Vertical Machine.

Designed For Rapid Tooling Set-Up And Ease Of Operation.

MACHINE SPECIFICATIONS #V-187

- Max. diam. wire—inches ..... .187
- Max. length of feed—standard 15"
- Max. length of feed—with change gears ..... 30"
- Max. width ribbon metal ..... 1¼"
- Stroke of forming slides ..... 2½"
- HP. required 2
- Machine speed—standard 30-120 RPM
- 4 and 20 ton Press Attachments available.

ADVANTAGES OF THE NILSON VERTIFORM

1. Greater Tool Accessibility
2. Unobstructed View Of Product Being Formed
3. Forming Slide Units Removable and Interchangeable
4. Less Floor Space Required
5. Operator Safety (Most Moving Parts Enclosed)
6. Automatic Oiling Of Entire Machine

Write To Our New Plant For VERTIFORM CATALOG

THE A. H. NILSON MACHINE CO. Bridgeport Ave., Shelton, Conn.

NILSON

CIRCLE INFORM-A-GRAM KEY NO. 158

. . . Machines from page 157

chining heads. Quick change adapters in certain spindles facilitate the 28 tool changes that are made to complete the machining of the part.

This special machine is hydraulically operated and electrically controlled. The machining units are Snyder standard way-types that are provided with automatic lubricating systems. Separate hydraulic power packs provide power for operating the machine slide and index motions.

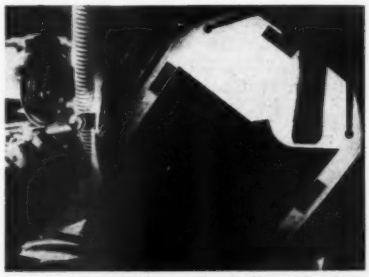
All machining units have hardened and ground ways. The tapping head has individual, automatically-lubricated, leadscrew drives for each spindle. The heads are driven by 7½, 10, 15 and 20-hp motors.

Maximum accessibility for tool changes is provided by building the machine in the form of two machining sections, each having a pair of opposed machining units.

MECHANICAL HOLDERS ADAPTED TO CARBIDE PROFILE INSERTS

Mechanical holders for solid carbide, finish form inserts used on the inner and outer races of tapered roller bearings, have many advantages over the shank and brazed carbide tip formerly used.

The Timken Roller Bearing Company announces that it is now possible to gang grind profile inserts, eliminate the brazing operation, obtain longer tool life and smaller tool inventory, and lessen scrap loss.



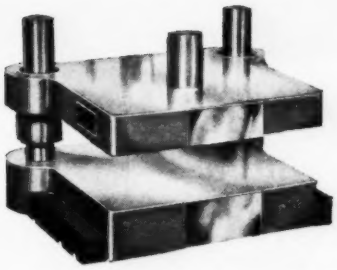
Inserts and diamond grinding wheel at left are shadow-projected on screen during gang grinding operation.

Profile gang grinding of 16 tips at a time takes about 8 hrs as compared to the 24 hrs required previously for the same number of brazed tools. Grinding time saved per tip is about 30 to 60 min depending on the profile to be ground.

Life of the carbide insert tip exceeds that of the solid shank and tip. Carbide "too hard" to braze safely made it necessary to use a softer grade, lowering the performance life of the tool. Mechanical holders permit the use of the best grades of

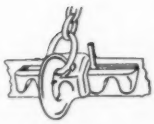
. . . *Continued on page 160*

HANDLE LARGE AND SMALL DIE SETS SAFER·FASTER·MORE EFFICIENTLY



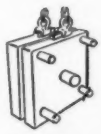
ONLY SUPERIOR *precision all steel*
DIE SETS *offer exclusive safety and handling features.*

Three features exclusive with SUPERIOR DIE SETS permit rapid assembly, disassembly and overall handling of large and small die sets. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging of valuable press equipment. **In addition, all Superior Die Sets are jig bored to your specifications — result number of sizes practically limitless.** Write for FREE 24 page Catalog on Superior Die Sets and Supplies.

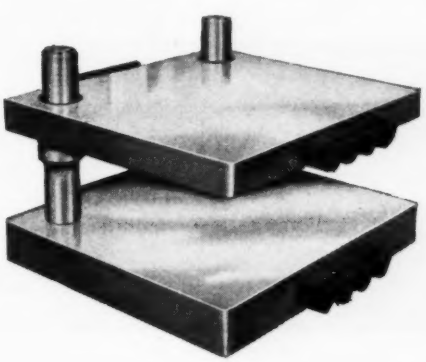


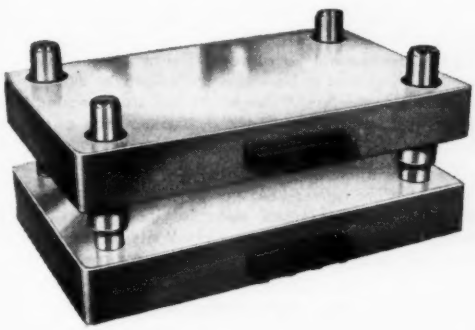
LOCK-JAW LIFTING DEVICE
removes the danger of handling large die sets.

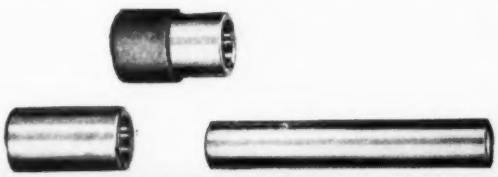
SAFETY FLANGE
protects fingers by providing roomy gripping space on either side of the die shoe.

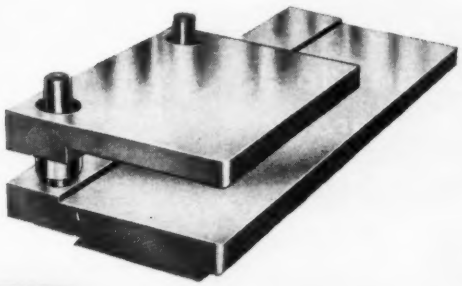


E-Z LIFT SLING CHAIN
attach to the lock-jaw for immediate lifting.









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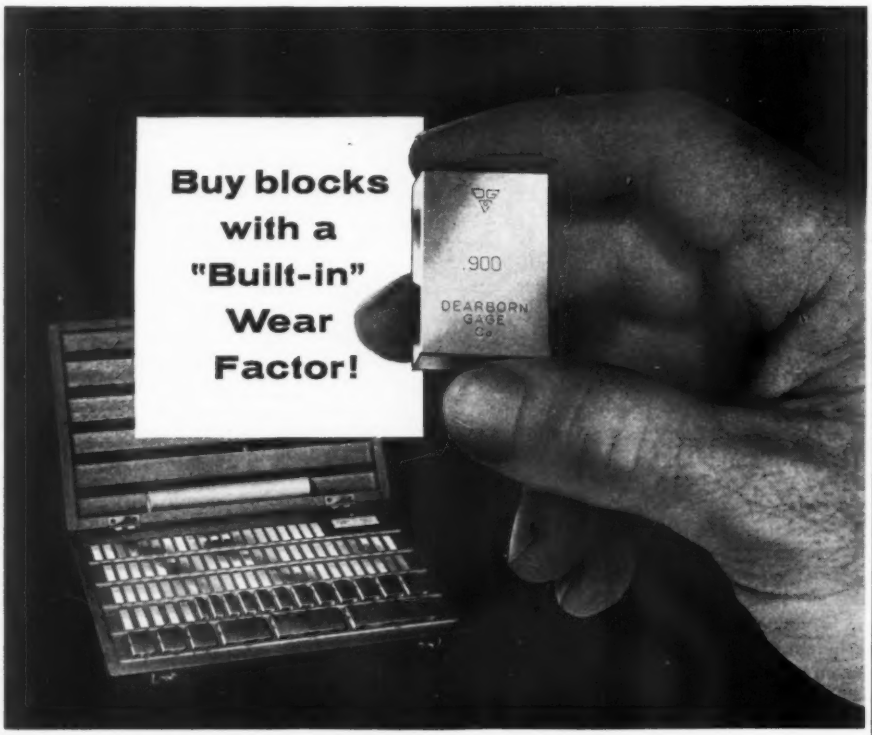
2754 S. 19th ST., MILWAUKEE, WIS.

MULTI-SLIDE SETS TO YOUR SPECIFICATIONS

CIRCLE INFORM-A-GRAM KEY NO. 159



ELLSTROM CHROMIUM PLATED GAGE BLOCKS are guaranteed "minus nothing" from nominal size!

Here at last are gage blocks with a positive "built-in" wear factor! The only blocks ever produced and priced as standard with dimensional accuracy unconditionally guaranteed to be within specified millionths on the "plus" side of nominal block size and minus "zero" . . . absolutely nothing . . . undersize!

This complete elimination of the conventional minus tolerance gives you, the gage block user, three new and exclusive benefits. First, it provides positive assurance against receiving new blocks that are actually "worn" undersize during manufacture before they are ever used. Second, it gives you finer, more practical accuracy . . . with the sure knowledge that every Ellstrom block you buy will start wearing *toward* its nominal size rather than *away* from it. And third, it gives you a guaranteed minimum wear factor equivalent in millionths to the full minus tolerance specified as standard for all other makes of blocks!

Write for descriptive literature containing complete price information today!

ELLSTROM STANDARDS DIVISION

DEARBORN GAGE COMPANY
"Measuring in Millionths for Three Generations"
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REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

Ellstrom Gage Block Accuracy Guarantee

"W"—WORKING ACCURACY BLOCKS
Measured Length: +.000008"/−.000000"
Parallelism: .000004" Flatness: .000004"

"I"—INSPECTION ACCURACY BLOCKS
Measured Length: +.000004"/−.000000"
Parallelism: .000003" Flatness: .000003"

"L"—LABORATORY ACCURACY BLOCKS
Measured Length: +.000002"/−.000000"
Parallelism: .000001" Flatness: 000001"

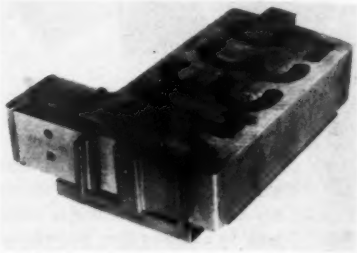
Ellstrom—your best buy in gage blocks for shop and tool room use, inspection and laboratory applications. Available in 28 standard sets ranging from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories.

CIRCLE INFORM-A-GRAM KEY NO. 160

. . . Holders from page 158

carbides for tips. The bits are ground from a standard (1410) piece of carbide.

The heat from the brazing operation threw a strain on the tip that was difficult to detect. The softer metal of the steel shank contracted and expanded to a greater degree under temperature changes than did the carbide tip, and the stress or invisible fault that sometimes developed caused the tip to crack under use.



Carbide insert bits secured in mechanical holder.

A brazed tool can be reground from four to six times. The insert bit does the same or better with smaller scrap loss of worn-out tools. With the mechanical holder, only the tip is discarded when it can no longer be reground. The shank and brazed tip must be scrapped together. The shank cannot be used again by brazing on a new tip.

Only two sets of mechanical holders are needed for each machine. If a different radius is to be cut, only the bit is changed. Elimination of the extra number of shanks previously needed saves space in the toolroom and greatly reduces inventory costs.

The insert is held in the mechanical holders by a side clamp and supported from behind by an adjusting screw. Changing from a dull bit to a sharp one is much simpler since the holder does not have to be removed. Setup time for running new jobs is accordingly reduced.

NECROLOGY

William J. Magee, 68, retired treasurer and director of Norton Company, died Aug. 26 in Worchester, Mass.

Archer W. Richards, 72, chairman of the board and general manager of Designers for Industry, Inc., died suddenly at St. Luke's Hospital in Cleveland on Aug. 16.

William Ernst Caldwell, 73, chairman of the board of The Cleveland Twist Drill Company, died Aug. 22 after a brief illness. The same day, Harold C. Hurtt, 44, assistant to the vice president of sales at The Cleveland Twist Drill Company, died suddenly following a heart attack.

Small-lot production of step shafts more than triples

...when Warner & Swasey No. 3 Electro-Cycle® with Versatile Step Turner, Handles the Job at Hobart Brothers Co., Troy, Ohio

Also, their Electro-Cycle's flexibility and ease of job changeover permit the handling of a wide variety of less complex work in lots of 5 to 50 pieces. As many as 17 jobs have been completed during a 9-hour shift!

Hobart Brothers Co., one of the world's largest manufacturers of electric arc welding equipment, relies on their new Electro-Cycle Turret Lathe to machine a majority of the smaller turned components in their motor generator sets.

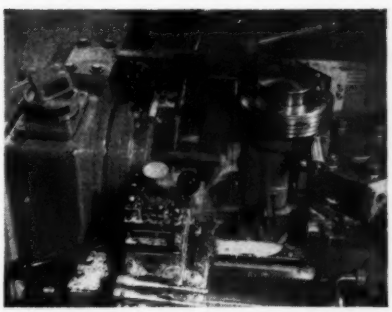
The Electro-Cycle's Step Turner attachment enables the automatic turning of five separate diameters in a single setup. The part being machined is completed by using only five stations on the hexagon turret—end stop, center bar end, center support, step turn and then thread. Necking for grinding and thread relief is easily handled from the square turret.

As all shafts are subsequently ground, Hobart holds their machining tolerances to +.005" −.000". These tolerances are easily handled by the versatile Step Turner attachment.

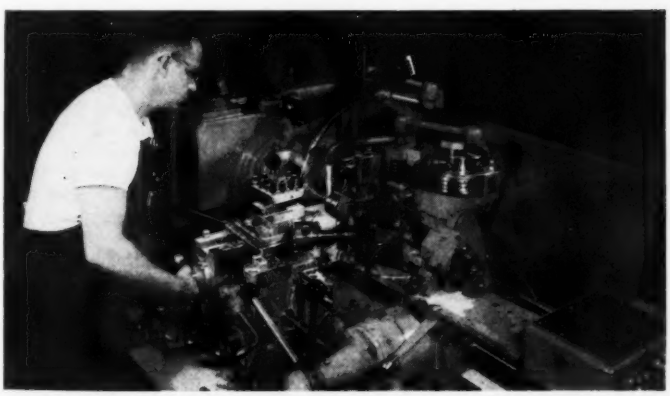
An AISI 4140 steel governor shaft was formerly produced at the rate of 2 to 3 pieces hourly—now one is finished each 4 to 5 minutes. As their shafts are produced from standard mill lengths of bar stock, the Electro-Cycle's Power Bar Feed and Collet Chuck have proved to be a great fatigue-saver to the operator.

Contact your nearest Warner & Swasey Field Representative to get the complete story on how Electro-Cycles can radically improve your production—and profit picture, too. He's as near as your telephone, so call today.

® Reg. U. S. Pat. Off.



On this versatile Step Turner attachment—once the initial cutter setting has been established—two to four different diameters can be easily selected by simply turning the micrometer dials to desired diameters. If needed, a fifth diameter may be obtained by using the stop screw located at the lower rack's end. Step Turners are available with diameter capacities ⅜" to 1½" shoulder lengths variable as required, with a total length limitation of 10 inches.



This Electro-Cycle Turret Lathe, shown operating at Hobart Brothers Co., is used for both long and short run production. Automatic, electrical control of all spindle functions greatly reduces machine handling time. They handle a wide variety of jobs in materials from copper and brass up to the toughest alloy steels used today.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

CIRCLE INFORM-A-GRAM KEY NO. 161

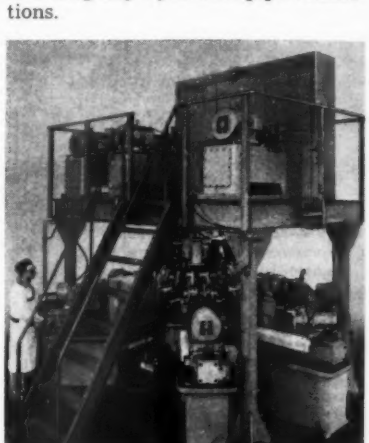
ROTARY INDEX MACHINE FEATURES AUTOMATIC TOGGLE CLAMP FIXTURES

A new high production, eight-station, rotary index automation machine that accurately positions and performs machining operations on the bore and hub face of production parts by means of unique automation devices is now available.

The machine, manufactured by the Expert Automation Machine Company, was designed for minimum floor space. It spotfaces, reams, bores, and Bearingizes the sintered iron bore and thrust face of 6" dia automotive water pump impellers at a production rate of 700 pcs/hr at 80% efficiency. By changing the fixtures and heads, this machine can be adapted to a variety of both large and small parts requiring accurate machining operations.

The machine features 16 overcenter toggle type clamping fixtures (two per station) which automatically center and square the part and clamp it in position prior to the machining operations. A unique expandable rubber automatic unloading mechanism removes the part from the fixtures after all machining operations have been completed.

All machining heads are mounted on Expert standard way units. These electrically controlled and hydraulically operated way units have an advance and return rate of 300 ipm and a thrust of 7000 lbs. The way unit feed valve and hydraulic cylinder are manifold connected to an internally drilled manifold block. This design eliminates all piping within the unit which reduces the possibility of leakage and permits rapid replacement of the feed valve or hydraulic cylinder without making or breaking any hydraulic pipe connections.



The index table is driven by an Expert standard cam index mechanism with a mechanical shot pin. The high torque rating of this index mechanism permits the indexing of the 2500-lb table (including fixtures) from station to station in 1¾ sec without any shock or impact.

During the automatic index from one station to another, the shot pin retracts and the table then raises, indexes, and lowers into the next station. The shot pin then moves into position and accurately locates the table in station. This raise-index-lower sequence prevents skidding of the table on the reference pads and eliminates pad wear.

The index table contains 16 positioning and clamping fixtures. Two fixtures index to each of the eight stations and parts are machined two at a time.

If your feeling the PINCH...
For want of a PUNCH...
Talk to the people at
3P
It's a fast service company, staffed with personnel who know that "DOWN-TIME" is "LOST-TIME". Distributors in principle cities assure IMMEDIATE DELIVERY from over 37,000 sizes in stock.
You get the finest quality in 3P HEAD PUNCHES and DIE BUTTONS, because they are made from 3 types of the finest tool steel, and are available in any DECIMAL size.
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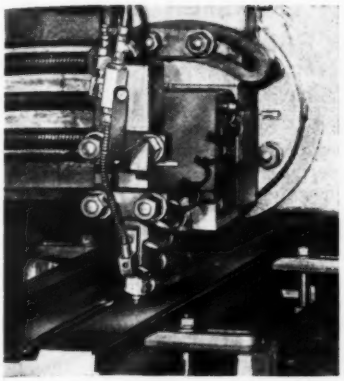


ANOTHER MIST-COOLING SUCCESS STORY

Fischer Machine Company, Philadelphia, Pennsylvania, solved their difficult planer job in cutting SAE 1035 channels by teaming Kennametal Tungsten Carbide Tools with a MILFORD Atom-Lube for Mist Cooling. Cutting at 300 S.F.P.M. with a feed of .050 inches, excellent tool life was obtained with the elimination of heat checking and tool breakage.

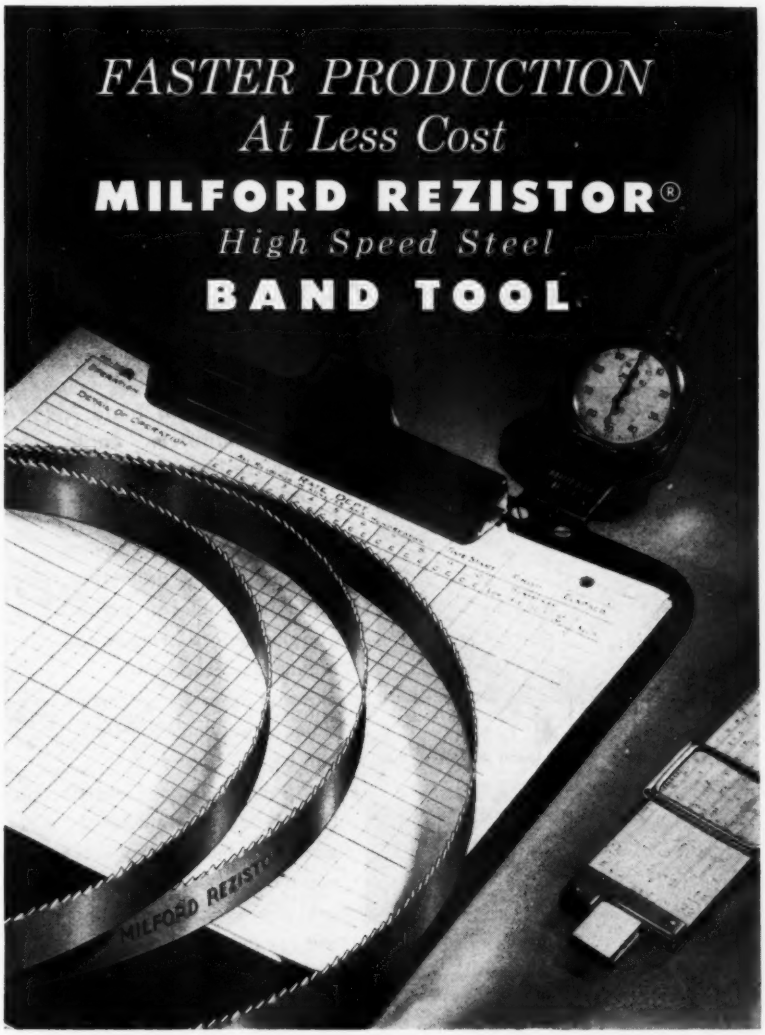
MILFORD Atom-Lubes are ruggedly designed for mist cooling tough industrial applications such as this Fischer Machine Company job. With an established record of success in sawing, grinding and milling, the MILFORD Atom-Lube offers new performance horizons for many other metal cutting tools. Adaptable to any piece of equipment, the MILFORD Atom-Lube is a natural where heat is a factor in any metal cutting operation.

FASTER CUTTING OF MODERN, HARD-TO-MACHINE METALS

Band Saws made of high speed steel proved the answer to Lukens Steel Company's* unusual sample cutting problem at its mill in Coatesville, Pennsylvania. Rolling heavy armor plate, up to two inches thick, requires constant metallurgical sampling to insure quality control. However, due to the great toughness of the plates, fast economical cutting of samples was difficult and production delays resulted. Lukens Steel Company now uses MILFORD REZISTOR High Speed Steel Band Tools.

The Henry G. Thompson & Son Company, makers of MILFORD Hack and Band Saw Blades and other products, recognizes that today's tough, hard-to-machine alloys and stainless steels demand new and improved cutting tools. A pioneer in metal cutting, MILFORD has been responsible for many important advances and industry firsts in the field. Once again, MILFORD has led the way with the development of the first band saws made of "red hardness" high speed steel. These blades are MILFORD's answer to industry's requirement for more accurate, faster cutting, high production cut-off band tools.

Distributor serving Lukens Steel Company — Diamond Specialty & Supply Company



NOW AVAILABLE FOR IMMEDIATE DELIVERY... the REZISTOR Band Tool is specially designed for your heavy-duty band saw machines. This *red-hardness high speed steel* blade cuts many times faster . . . lasts far longer than any carbon steel band. It cuts consistently smoother and straighter than other cut-off methods . . . and chip loss of expensive metal is greatly reduced.

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BUY FROM YOUR MILFORD DISTRIBUTOR . . . a local businessman who stocks the tools and equipment you need. You'll SAVE TIME, CUT BUYING COSTS and REDUCE INVENTORIES.

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Saw Blade Specialists for Over 80 Years

HACK SAW AND BAND SAW BLADES • HOLE SAWS • GROUND FLAT STOCK

CIRCLE INFORM-A-GRAM KEY NO. 163

Zagar Gearless Drill Heads

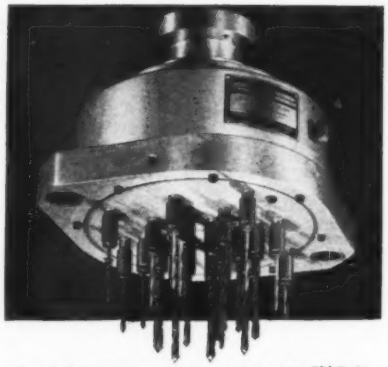
put 4 big advantages to work for you

Any number of holes

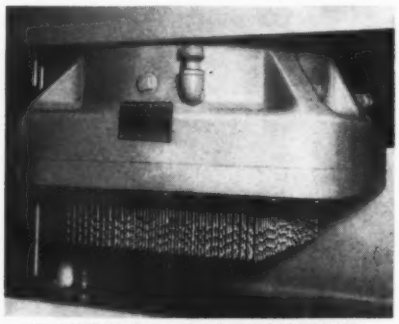
Any hole pattern

Any material

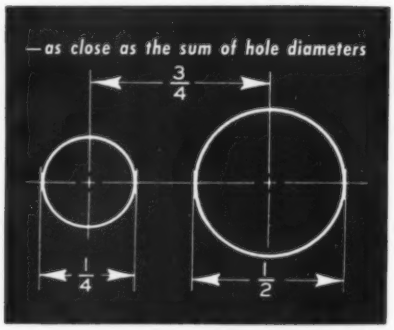
On all centers



Any hole pattern—on any center up to 1½" dia.



Up to 1200 holes can be drilled IN ONE PASS.



A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possibe by drilling up to 1200 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer — one *best* answer — for those requirements. May we supply it?

Get more information via Zagar's Engineering Sheets "T-10".

ZAGAR INCORPORATED
23894 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

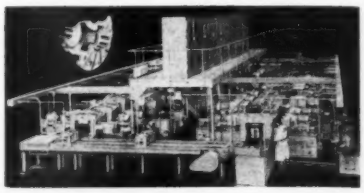
CIRCLE INFORM-A-GRAM KEY NO. 164

TRANSFER MACHINE PROCESSES 212 GEAR CASES PER HOUR

One of the big three automobile companies is now machining its one-piece rear axle differential gear cases on a new special machine that also performs the difficult operations on the inside of the part formerly done on single-station machines.

The machine developed by The Cross Company is the first of its kind in the industry. Machining two parts at a time, the new Transfer-matic rough and finish forms the two spherical seats for the pinions; rough and finish bores and faces the two seats for the side gears; drills, bores, and reams the pinion shaft hole; drills and reams the lock pin hole; and drills, chamfers, spotfaces, and reams 12 ring gear mounting holes.

Rated capacity of the machine is 212 pcs/hr at 100% efficiency.



The gear cases are transferred through the machine on pallet-type work holding fixtures. Part location in the pallet fixture is from the ring gear seat and one of the two end bearing diameters, which are turned and ground in previous operations.

Movement from station to station is accomplished with two reciprocating transfer bars. At the forward end of the transfer stroke, elevators lift the pallets from the bars into engagement with fixed locating pins and rest buttons, which are attached to overhead bridge structures. Wedges then back up the elevators to secure the pallet fixtures in final position.

In stations where internal boring and facing operations are performed, the overhead bridges also carry the cutters. As the pallets are elevated to the clamped position, the cutters enter the part and find their correct location relative to the gear case. After the cutting operations are completed, the elevators lower the pallets back onto the transfer bars which carry them to succeeding stations.

Transfer and indexing errors are minimized because the locating pins are positively fixed and do not move. Side gear and pinion locations are maintained in closer relationship as the parts are not relocated and clamped between operations.

Any similarity to a real-life company is purely intentional

How do they keep their cotton-pickin' fingers clean in Cincinnati?

The folks at the Fluffy Stuff Company like any color as long as it's *white*.

When they celebrate, they paint the town white. When they do most anything, they do it up white . . . to the hilt.

They have a white complex. It figures, though. They process cotton. And to be acceptable, their products must have the hue of a polar bear in a snowstorm.

So all was consternation one day, let us tell you, when rust-stains were found on some cotton batting! The air turned blue. Faces became red.

And a search was started to find the culprit. Everybody joined the posse.

Turned out it was a semi-steel spider ratchet in a machine for drying and breaking-up matted cotton batting. It not only deposited, you'll pardon the expression, rust — but some of its spokes or fingers were broken to boot.

But all was not lost. Seems like one of Fluffy Stuff's maintenance men had heard about Ampco Metal, a whole series of special copper-base alloys. (Read some of our ads, we hope.)

At any rate — to make a long story short — the company investigated Ampco Metal. Thought it looked like it had possibilities. Tried it.

At last report, Ampco Metal had not only provided freedom from rust—but it actually had lasted five times longer than the previous part!

But that's not all of the story. Fluffy Stuff was also having trouble with a brass rake used to dig up wet cotton as it passed through a washing machine. The rake had fingers 8″ long x 1″ wide x ½″ thick.

F. S. had a replacement made of Ampco Metal—and it lengthened the life of the rake fingers by 20 times!

Now maybe you make conveyors or condensers, instead of cotton products. But if wear or corrosion are factors to be concerned with, you should look into Ampco Metal. There's an Ampco field engineer nearby who's ready to focus his attention on your particular problems. Call him.

And write for Bulletin 33. *Ampco Metal, Inc., Dept. TP-10, Milwaukee 46, Wis. (West Coast Plant: Burbank, Calif.).*

AMPCO® METAL

The metal without an equal

6-9

CIRCLE INFORM-A-GRAM KEY NO. 165

REMOTE CONTROL SYSTEM DESIGNED FOR DANGEROUS LATHE WORK

A new remote control system is making it possible to operate certain lathes with air-gage tracer equipment from a distance of 12′ or more.

Designed by the Monarch Machine Tool Company for their Series 62 lathes, such operations as machining radioactive materials or contouring solid propellants for rockets or missiles, may be accomplished whenever it is desirable to position the operator at a distance from the machine. The new remote control system consists basically of an electrical control cabinet and operating panel, plus a separate auto cycle control stand, both connected to the machine by flexible conduit.

The lathe's main drive motor can be started, stopped, or reversed; the spindle can be jogged, run, braked, or shifted to a second pre-selected turning speed, and feed rates may be varied according to workpiece requirements — all from the remote position. Actual tool movements, of course, are regulated during operation by the air-gage tracer mechanism mounted directly on the machine, with the complete cutting cycle, including traverse return, under fully automatic control.

Using this new control arrangement, it isn't necessary for the operator to see the machine while turning is in progress.

Since there is no practical limit to the length of conduit which may be used to link the lathe with its control equipment, this equipment can be located in an independent area, if required. The separate auto cycle control stand, however, may be moved close to the machine for set-up, then moved away again during the cut.

Controls mounted on the operating panel of the electrical control cabinet include the main drive motor start, stop, and reverse pushbuttons, a selector lever for spindle control, and a drive motor horsepower meter.

For convenience in set-up, both the drive motor pushbuttons and the spindle selector lever are duplicated at the machine. As a safety measure, however, the remote start and reverse pushbuttons for the drive motor incorporate a lock-out arrangement, preventing their actuation while the operator is at the lathe for set-up or work change purposes.

Located on the separate, and portable, auto cycle control stand are: an energizing switch and pilot light; a cycle stop button which, when depressed, stops the automatic cycle at any point; the cycle reverse button which functions as an emergency

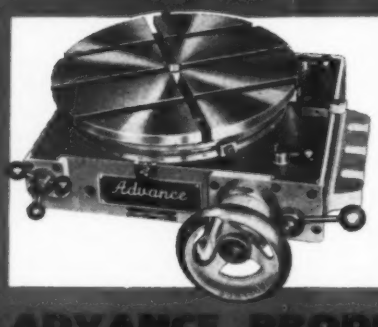
. . . *Continued on page 168*

CUT TOOL and DIE MAKING COST . . .
By Reducing Set-up Time as Much as 90%

ADVANCE CROSS SLIDE ROTARY TABLE

Permits fast, precise positioning of workpiece from ONE SET-UP. No unclamping and reclamping on your standard vertical mill equipped with ADVANCE Cross-Slide Rotary Table.

30 Seconds Accuracy
(Comparable Tables Cost Twice As Much!)



ADVANCE 15" ROTARY TABLE

This rugged, precise tool is designed for all types of work requiring rotational accuracy. Its maximum speed and precision, and minimum maintenance fills the need for a precision unit at a moderate price.

ADVANCE PRODUCTS CORP.
N. Shore Dr., Benton Harbor, Michigan

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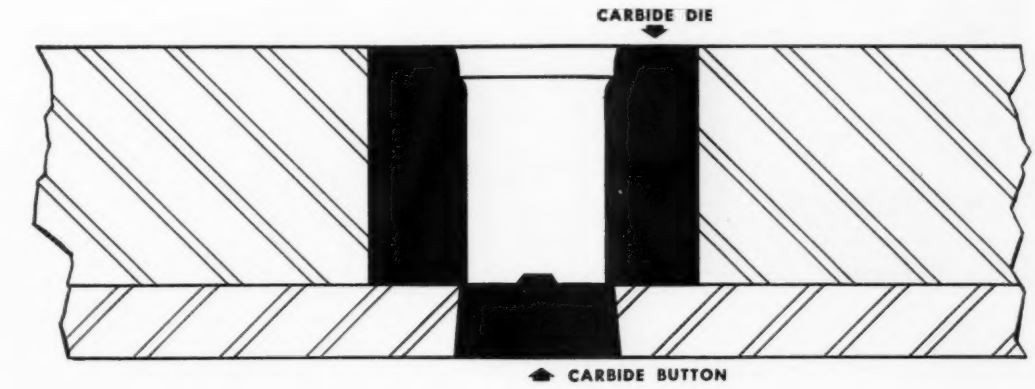

Cross section of Carboloy carbide-equipped die used by Federal Drop Forge Co. The die cold-extrudes SAE 1010 steel blank (A) into ball seat (B) for automotive steering mechanism.

Cold-extruding 1010 steel ball seats . . .

AN EXTRA DAY'S OUTPUT EVERY 3 DAYS WHEN CARBOLOY® DIES REPLACED STEEL

Carboloy cemented carbides are harder than steel — and far more resistant to wear. That's why carbide-equipped cold-extrusion dies save an average of 2½ hours of press downtime *per shift* at Federal Drop Forge Co., Lansing, Michigan.

When steel dies were used, they were polished each shift . . . and the button (see diagram) had to be reground. Time lost: 2½ hours per shift, or the equivalent of one working day every three days. Steel die life averaged 25,000 pieces; steel buttons produced about 15,000 pieces per grind.

Now that Carboloy carbide dies and buttons are used, only occasional polishing is required. One die has produced almost 1 million extrusions in 2½ years with only .0003" wear . . . and carbide button life averages 2 million pieces.

In addition to longer die life, a costly centerless grinding operation was eliminated because, with carbide dies, specified tolerances are held from beginning to end of the run. And, the surface finish after extrusion is better than previous centerless-ground finish.

The unique properties of Carboloy cemented carbides can be used just as effectively on drawing, forming, or blanking operations. Check with your diemaker for more information. Or write: *Metallurgical Products Department of General Electric Company, 11111 E. 8 Mile Ave., Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

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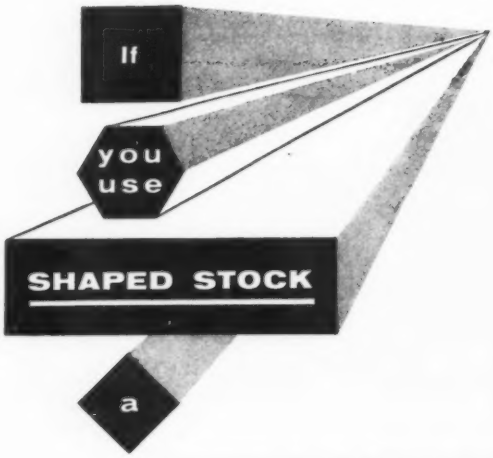


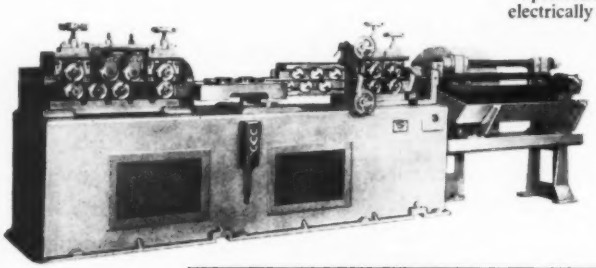
SHUSTER
Shape Stock Straightening and Cutting Machine

Gives It To You Straight!

SHUSTER, the nation's oldest name in wire straightening and cutting, now offers a *complete* line of shape stock machines — first in the field again! For manufacturers of electric motors, wrought iron furniture, and wherever shape stock in volume is needed, SHUSTER offers the economical answer to accurate, straight, square cut stock.

3AVF

Capacity: to ⅜" square, or ¾" width. Infinite variable speed drive — geared to feed *76* to *228 feet per minute*. Solenoid operated roll-type clutch — electrically controlled cut-off.



Other Shuster Shape Stock Straighteners			
	Geared to Feed	Square	Max. Width
1AF	150 FPM	1/8"	1/4"
1AVF	50-200 FPM	1/8"	1/4"
2AF	125 FPM	3/16"	3/8"
2ABF	120 FPM	1/4"	5/8"

Write today for complete details!

METTLER
MACHINE TOOL, INC.
150 West Adeline Street, New Haven, Conn.
CIRCLE INFORM-A-GRAM KEY NO. 168

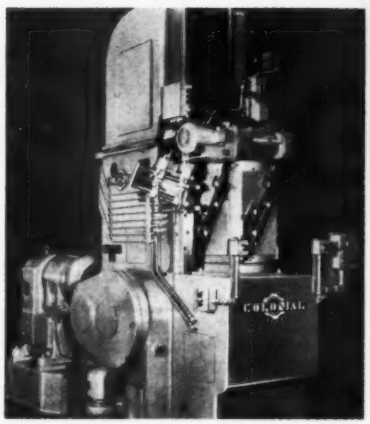
. . . Lathe Work from page 166

control by returning the lathe carriage to the "start" position at any time during the cycle; and a potentiometer feed control offering an infinite variation in the feeds that can be selected during the cut. Also included in this control grouping is a large feed meter, reading in inches per minute. This meter not only facilitates accurate feed adjustment with the potentiometer control, but allows feed rates to be monitored easily during the cycle.

Where certain critical machining jobs are involved, and it is essential that the lathe operator be able to follow the progress of the cut from the remote control position, a closed circuit television hookup can be employed to provide the necessary close-up view.

Eight Oil Grooves Broached on 640 Shafts per Hour

Eight oil grooves plus an identification notch are broached in one pass by a standard vertical-chain surface-broaching machine at a speed of 35 fpm.



This 10-ton, 160" stroke unit built by Colonial automatically broaches 640 rocker arm shafts/hr at 80% efficiency. The shafts are manually loaded two at a time in a retaining fixture, automatically clamped by hydraulically operated wedges, probed for correct location, broached, and unloaded by air ejection in a cycle time of 9 sec.

The broach "rams" are platen-mounted on an endless chain and enter precision ways before contacting the work.

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SAVINGS BONDS

EDLUND

Edlund 2F Drilling Machine in use at Pratt & Whitney Co. West Hartford, Conn., drilling, reaming and tapping precision parts.

Edlund Model 2F Drilling Machines at PRATT & WHITNEY

Pratt & Whitney, famous manufacturer of machine tools — Jig Borers, Keller Machines, Gages and Cutting Tools, uses Edlund Drilling Machines to assist in the production of precision parts.

Modern features —
Flexibility of infinitely variable speeds • Rugged construction for sustained accuracy typical of Edlund; • No Loss of Production Time Changing Belts or Gears.

For complete information and specifications about Edlund Model 2F Drilling Machines for your jobs, write for Bulletin 140R.

Production Line of
Edlund 2F Drilling Machines
at Pratt & Whitney featuring —

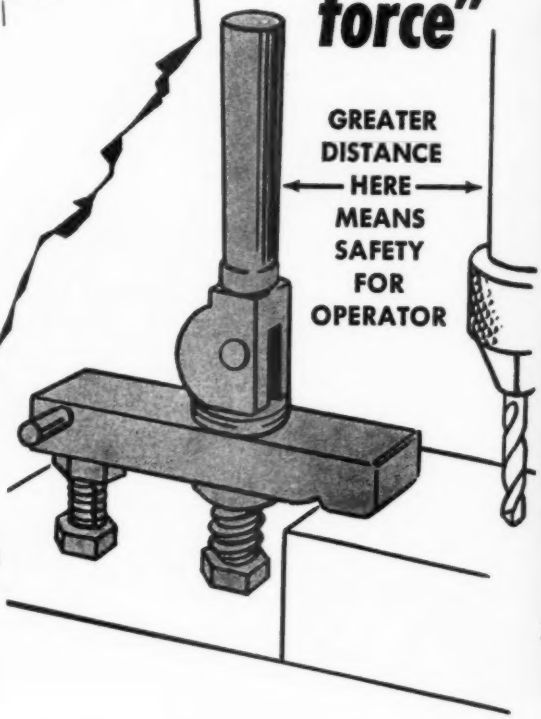
- Power Table Lift
- Extra Spindle Travel
- Reversing Motor Tapper

EDLUND REPRESENTATIVES IN MAJOR CITIES

EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

*CERTIFIED . . . "up to 3,450 lbs. of clamping force"

*
THE JAMES H. HERRON CO.
LABORATORIES
Testing · Analysis · Inspection · Soil Investigation · Non Destructive Testing
1360-1364 WEST THIRD STREET
CLEVELAND 13, OHIO
MAIN 1-5443
May 11, 1956
The Standard Parts Company
1000 Broadway
Bedford, Ohio
Re: Our Order N-7261
Gentlemen:
With reference to the Double Cam-Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated.
Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt.



with

STANDARD'S DOUBLE ½" (500) CAM LEVER

This Double Cam Lever offers superior design and engineering features—assuring greater safety, performance, strength and durability.

- **Maximum Job Clearance.**
- **Safe Operation—with handle *vertical* before clamping (as illustrated).**
- **Constant Maximum Clamping Pressure—perpendicular to center line of lever.**
- **Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.**
- **Ready to Use—no altering needed on assembly.**
- **No Lever Breakage—solid steel handle.**
- **This cam can be applied to your specially designed assemblies. Quotations on request.**

If it's a Standard Part, you know it's GOOD!

OVER 500 OTHER STANDARD JIG AND FIXTURE COMPONENTS

Standard Parts Company offers the most complete line of fine quality tool room standards available today. All Standard components incorporate the latest safety, efficiency and performance features desired by the trade... as typified by the Double Cam Lever shown on this page.

You can depend on Standard Components...they will never let you down (with down-time and work stoppages). Our New Sixth Edition CATALOG—covering our complete line—is now ready for you. Tracing sheets are available.

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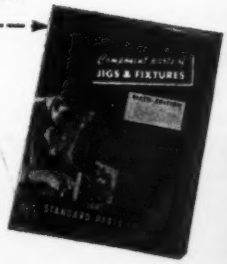

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A1	A20	A39	A58	A77	B6	B25	B44	B63	C14
A2	A21	A40	A59	A78	B7	B26	B45	B64	C15
A3	A22	A41	A60	A79	B8	B27	B46	B65	C16
A4	A23	A42	A61	A80	B9	B28	B47	B66	C17
A5	A24	A43	A62	A81	B10	B29	B48	B67	C18
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A7	A26	A45	A64	A83	B12	B31	B50	C1	D1
A8	A27	A46	A65	A84	B13	B32	B51	C2	E1
A9	A28	A47	A66	A85	B14	B33	B52	C3	E2
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A11	A30	A49	A68	A87	B16	B35	B54	C5	E4
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A13	A32	A51	A70	A89	B18	B37	B56	C7	E6
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A16	A35	A54	A73	B2	B21	B40	B59	C10	
A17	A36	A55	A74	B3	B22	B41	B60	C11	
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A16	A35	A54	A73	B2	B21	B40	B59	C10	
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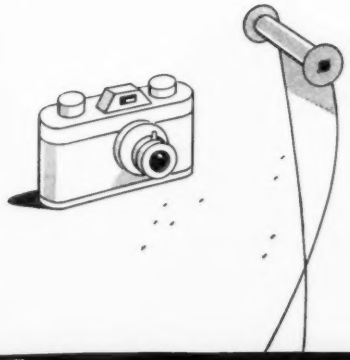
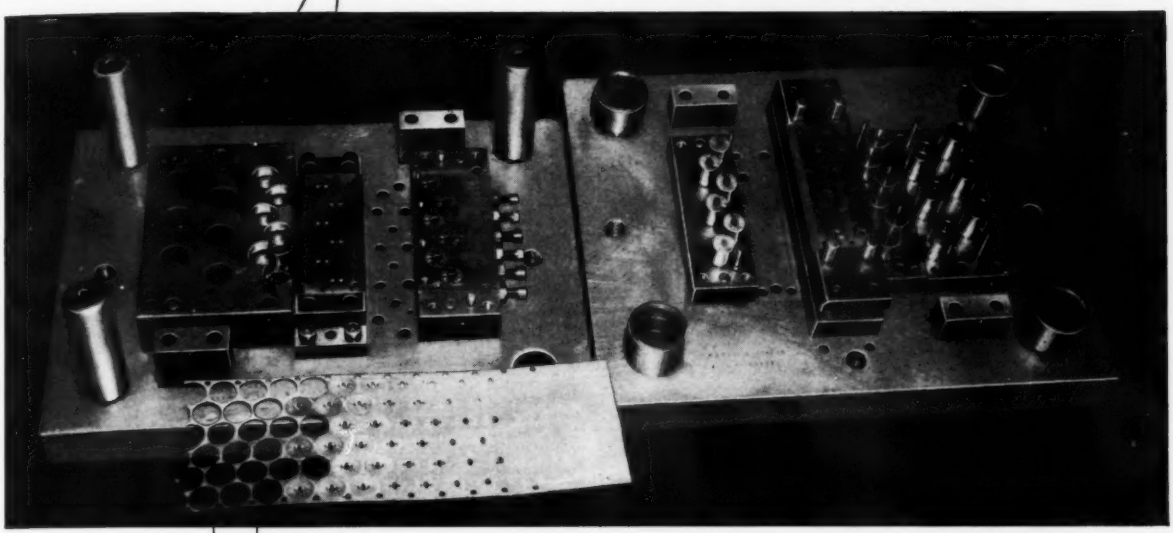
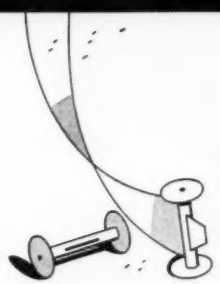


Over 150 Million Stampings from this ONTARIO Die





600,000 Film Spool Flanges PIERCED, EMBOSSED, STAMPED and BLANKED per Grind

Production engineers at an eastern camera manufacturing plant have reported excellent results from their Allegheny Ludlum Ontario film-spool-flange die. The Ontario die performs the multiple operations of piercing, embossing, stamping, and blanking.

Operating at 130 strokes a minute, the big die has produced over 150,000,000 parts. Runs as high as 600,000 have been made between grinds. For this operation, Ontario is air cooled from a temperature of 1850 F, then tempered at 350 F for six hours. This results in a Rockwell C hardness of 60-62.

A-L Ontario is an air hardening die steel of the high carbon/high chromium type. It has all the desirable properties of such steels—resistance to abrasion, high hardness and excellent non-deforming characteristics. In addition, it is tougher but easier to machine than the higher carbon/high chromium types which are usually oil hardening.

For the finest in tool steel to help solve your cutting, forming, trimming or blanking problems, call your nearest A-L office or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pa.*

Write for your
ONTARIO BLUE SHEET

A concise 4-page booklet of facts on the handling and shop treatments of Ontario. Included is complete information on forging, annealing, tempering, etc. and detailed laboratory data on physical characteristics. *Ask for your free copy.*

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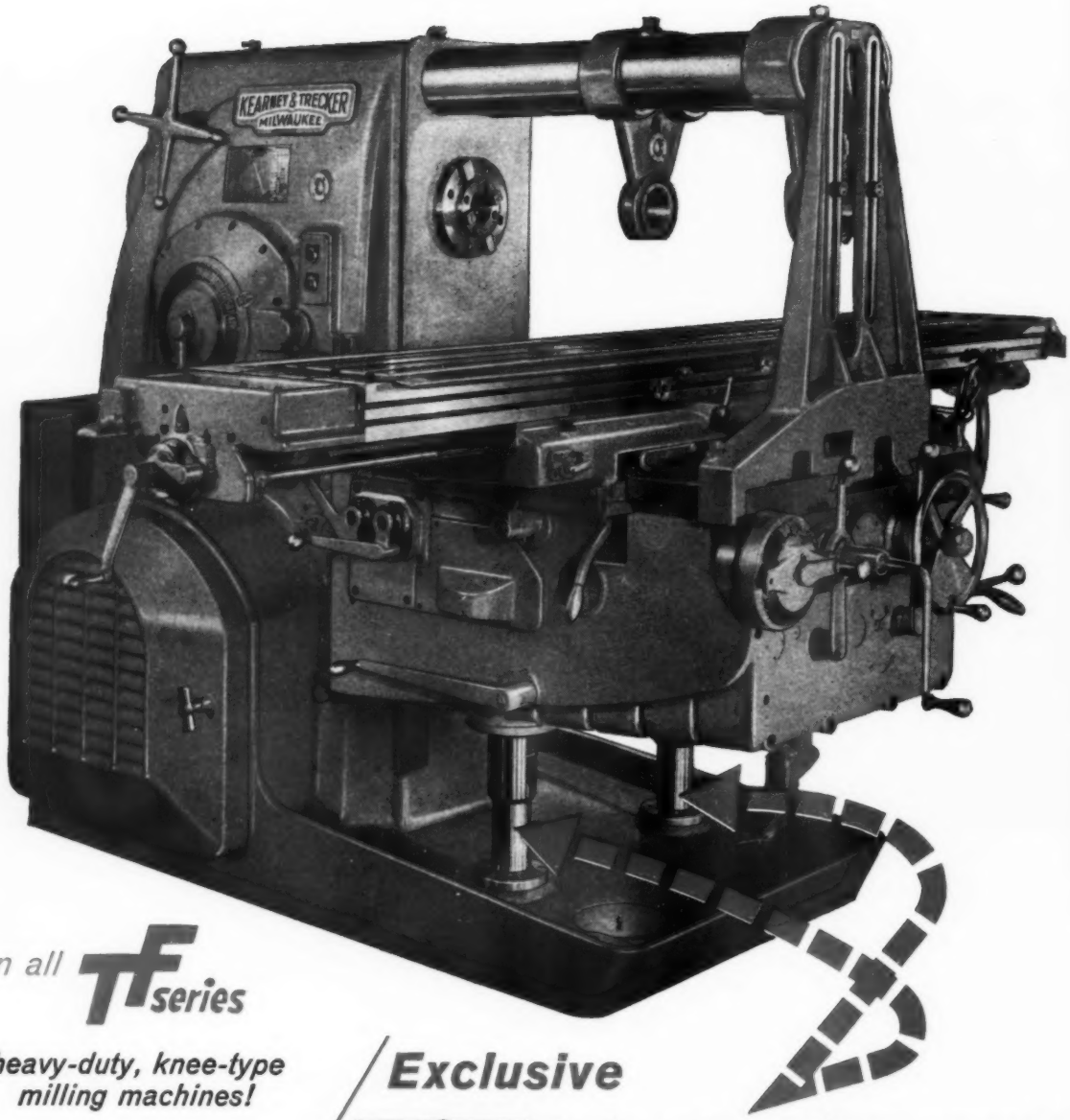

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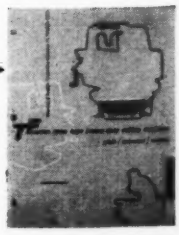

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LINE-STAFF RELATIONSHIPS IN PRODUCTION, Special Report 18. Published by the American Management Association, Inc., 1515 Broadway, New York 36, N. Y., 1957. 135 pages, $3.75 (AMA Members: $2.50).

Line-staff relationships are particularly important today because of the increasing number of specialists, says the AMA. To avoid friction, responsibilities must be clearly defined and understood by both line and staff.

In this report, tested methods for achieving production line-staff relationships are discussed by representatives of Merck & Co., Inc., American Safety Razor Co., Martin Co., and Pawling Rubber Corp.

Reporting on how staff departments can serve line management most effectively are executives from Minneapolis-Honeywell Regulator Co. and Stromberg-Carlson Co. A section on the contribution of the industrial engineer to the line-staff organization is handled by executives from U. S. Steel Corp., Norton Co., and Mergenthaler Linotype Co.

ESSENTIAL STRENGTH OF MATERIALS, by Frederick R. Lisarelli. Published by McGraw-Hill Book Co., Inc., 330 W. 42 St., New York 36, N. Y., 1957. 261 pages, $4.75.

The author's treatment of the subject is a practical one. His theory of strength of materials has been developed with the use of algebra and trigonometry alone. Formulas which cannot be derived without the use of calculus have been assumed. For these reasons, the book should be valuable in industrial training programs.

Other helpful features of the book include the following: Examples are worked out in detail without leaving steps to be supplied by the student. The problems are worked out with direct applications of the principles which immediately precede them. Tables of properties of materials are included as they become necessary for the solution of problems. A section on Simple Stresses deals with the accuracy of computation and significant figures so that the student will not try to overestimate the accuracy of his results. A section on welded joints is in step with the latest American Welding Society recommendations, and includes calculations on the strength of welded joints.

. . . *Continued on page 175*

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the *best* way with Steel City Brinell Testers

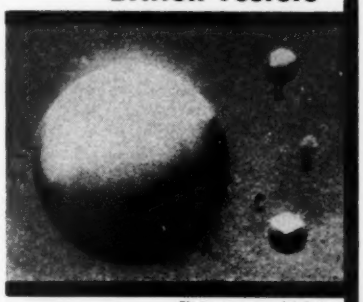

Photo courtesy of A.S.M.

Photograph illustrates the comparative size of impressions made by four different types of hardness tests:

(A) Brinell, (B) Rockwell "B", (C) Rockwell "C", and (D) Scleroscope. Because it covers a larger area, the Brinell impression (A) averages out small inequalities in hardness, surface finish, and complex internal conditions of the metal.

Steel City Brinell Hardness testers are designed to efficiently provide a *true* picture of the hardness of castings, forgings, bars and other comparatively rough and soft forms of metal. Models are available to facilitate the handling of the work with minimum of effort. *True, round Brinell impressions assure dependable testing results.* If a Brinell Hardness test is indicated for your material or product — contact Steel City for the *right* testing machine.

If one of the following types of test is your need—let us help you choose the Steel City machine that meets your individual requirement.

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Why the Contract Shop Owner Prefers PRODUCTO Die Sets

They help protect his profits

The contract shop owner prefers Producto die sets because they help protect his die performance...his delivery promises...his profits.

The shop owner favors Producto because he can choose from a wide range of die set styles and thicknesses in steel, semi-steel or a combination.

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The shop owner likes the fact that Producto offers him a choice of two classes of precision, and that *he pays only for the amount of precision he buys.*

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CIRCLE INFORM-A-GRAM KEY NO. 174

. . . Books from page 173

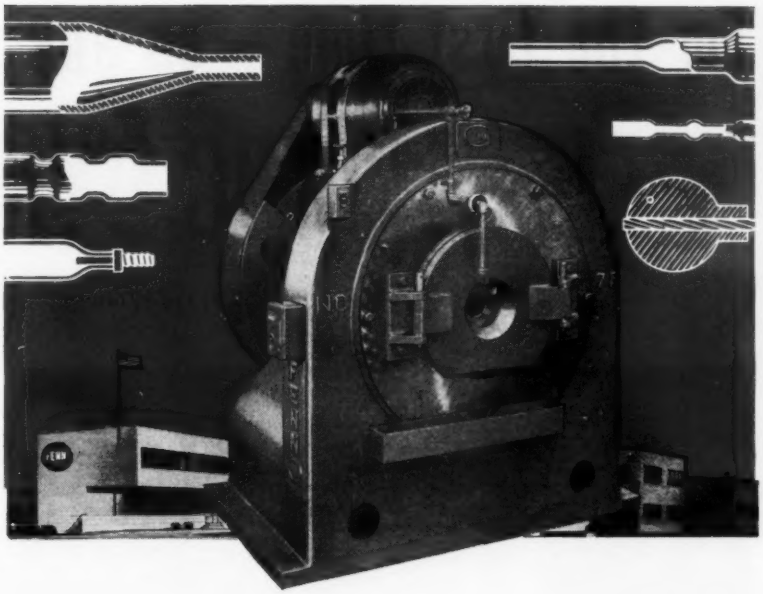
THE SCIENCE OF ENGINEERING MATERIALS, edited by J. E. Goldman. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., 1957. Based on the Proceedings of the Carnegie Conference on the Impact of Solid State Science in Engineering Education held at Carnegie Tech in 1954. 528 pages, $12.

Recent insights into the basic nature of atoms and atomic aggregates have brought into use revolutionary new materials and improvements in many of the standard materials. This book aims to give the engineer a feeling for these advances in materials technology and how they have come about.

Seventeen contributors set down the principles of solid state physics as they apply to the explanation of properties and materials. The first part includes chapters on applications of sold-state science in engineering: an introductory survey; structure of atoms and atomic aggregates; accomplishments and limitations of solid-state theory; and crystol imperfections. Part II covers those intrinsic and mechanical properties of a given metal or alloy system which depend on deviations from perfect structure. The influences of dislocations on the ultimate strength characteristics of metallic materials are presented in detail. Part III introduces surface structure and the role of surface phenomena. Parts IV and V cover semiconductors and magnetism, and the final part is devoted to non-crystalline materials.

MACHINE TOOLS: WHAT THEY ARE AND HOW THEY WORK, by Herbert D. Hall and Horace E. Linsley. Published by The Industrial Press, 93 Worth St., New York 13, N. Y., 1957. 426 pages, 363 illustrations, $5.50.

Successor to Linsley's "Machine Tool Primer," this book gives brief descriptions of all phases of metalworking operations. It begins by defining the metalworking industry in terms of its products, and then goes on to explain some of the important factors which make modern mass production possible: the skills in the machine shop, the kinds of machine tools that are used, the tooling-up of the machines, the gaging and inspection operations, the organization for production, and the ways in which time and motion study are employed to further efficient operation. It is not meant to be an all-inclusive reference text for technically trained persons, but is a good beginning text for engineering students and non-technically trained persons desiring an insight into the metalworking fields.



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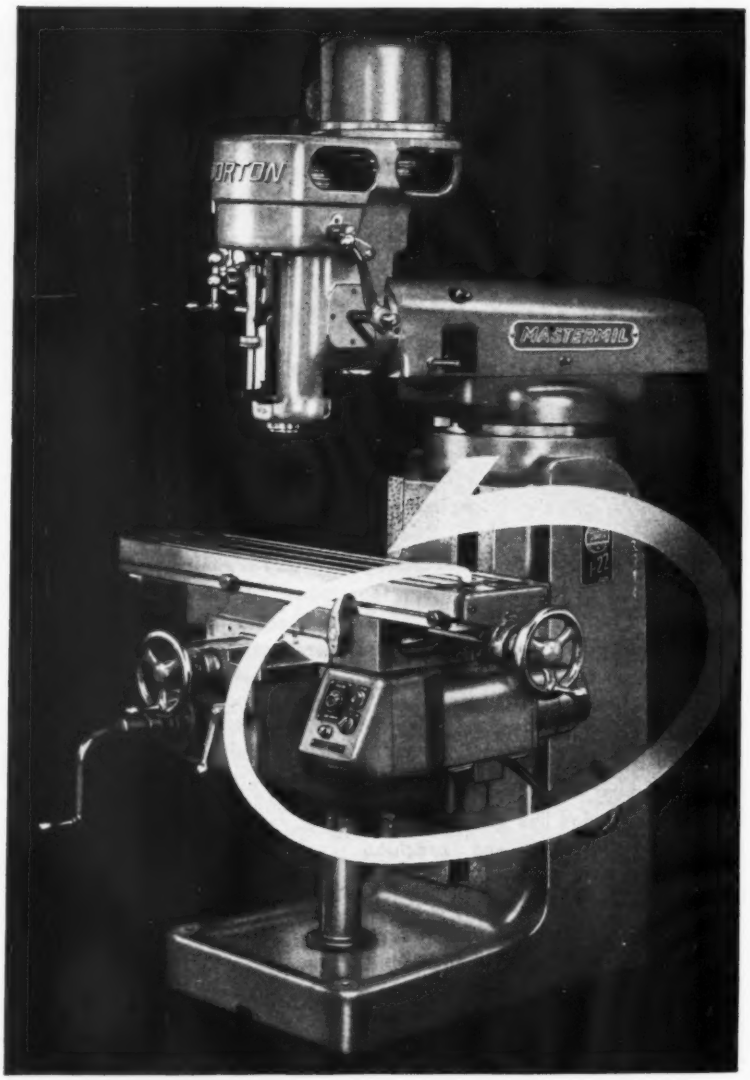

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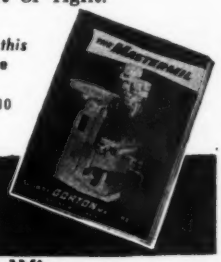

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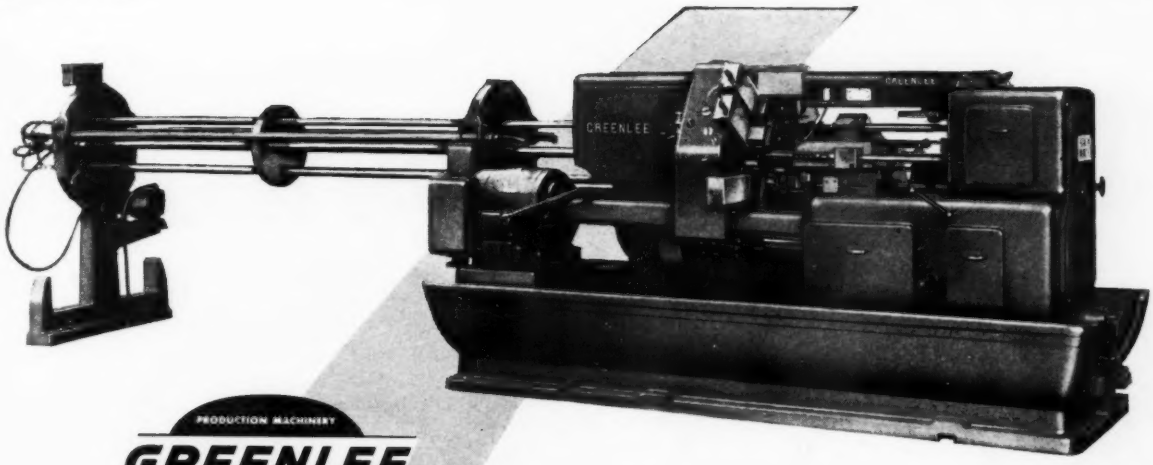

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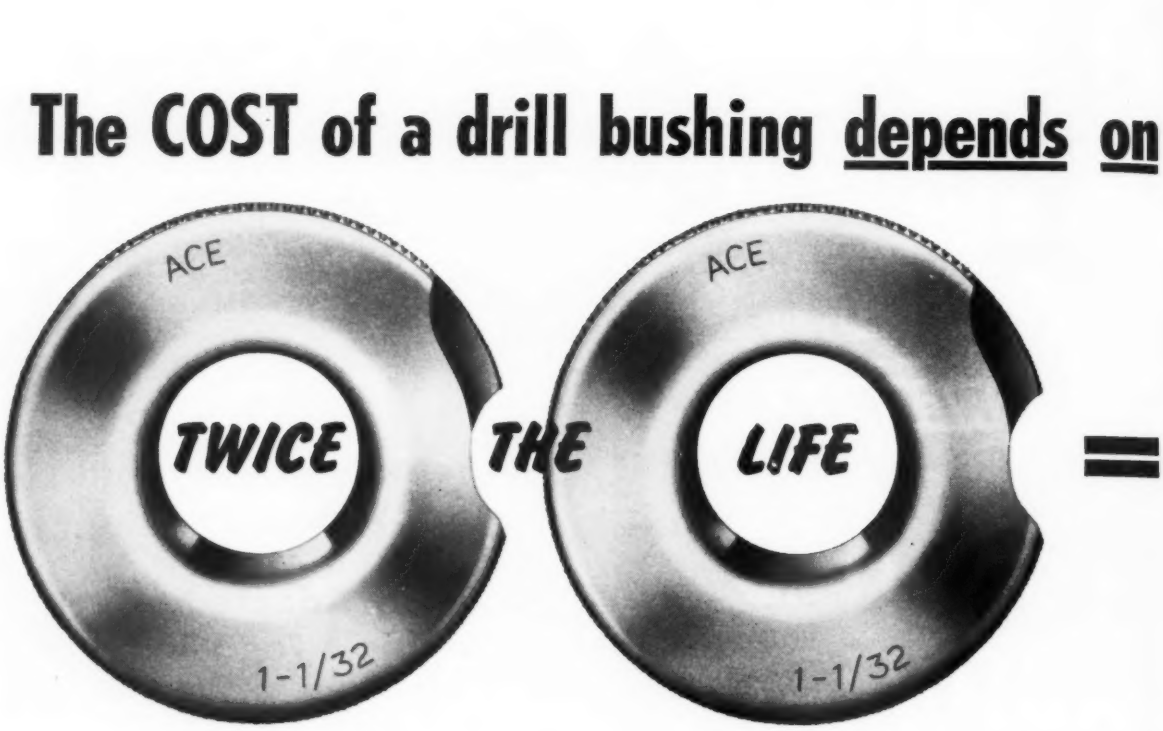
The COST of a drill bushing depends on



MEN YOU SHOULD KNOW

R. F. Mallina has joined the Gardner-Denver Co. as a research consultant, working with the company's Keller Tool Division.

◆

The appointment of **Stephen B. Sponder** as plant manager has been announced by Baker Bros., Inc.

◆

Reginald G. Schuler has become general engineering manager of Brush Electronics Co., and will direct the product engineering program. Manager of the Product Engineering department is **Ralph V. Little, Jr.**

◆

Charles B. Morgan, formerly superintendent of moulding and assistant manager of production at Synthane Corp., has moved up to general manager of production.

◆

Appointment of **Harold G. Hynd** as general manager of the Douglas El Segundo Division was announced recently by Douglas Aircraft Co., Inc. He succeeds **T. E. Springer,** who is retiring.

◆

Borg-Warner Corp., has announced the appointment of **Richard A. Powley** to the presidency of the Pesco Products Division of the company.

Robert Clark is now plant manager of Emhart Mfg. Co.'s Hartford-Empire Co. division Plant 3 and its Windsor St. Plant. He was formerly plant manager of the V & O Press Co. Division, and is replaced by **Neil Van Deusen** who was general sales manager of Henry & Wright and V & O prior to his new appointment.

◆

Larry Livermont, former works manager at Richmont Inc., is now assistant to the president of the concern. Chief engineer **Dick Ewell** is now production manager and will also continue his engineering responsibilities.

◆

Robert L. Strawbridge now serves as vice president and general manager of the Wales-Strippit Co., a unit of Houdaille Industries, Inc. The new general sales manager at Wales-Strippit is **Russell A. Johnson.**

◆

Micromatic Hone Corp. has promoted **John H. Greening** to chief engineer, and **Edward L. Behringer** has been named assistant chief engineer.

◆

The Waterbury Farrel Foundry & Machine Co. has appointed **C. Vincent Sciullo** assistant manager of the Cold Heading Machinery Division.

Lowell Jensen is now serving as works manager of Famco Machine Co.

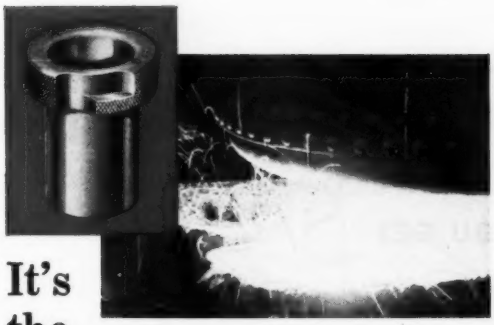
◆

Adrien F. Busick, Jr., formerly vice president of engineering, is now executive vice president and general manager of Marion Power Shovel Co. **Maurice V. Cornell** is now vice president of large machine sales, following the retirement of **David E. Rizor. William R. LeMasters** serves as vice president in addition to secretary-treasurer.

◆

Six promotions to new management positions have been announced by the Reliance Electric and Engineering Co. **Jay W. Picking** is manager of the Control Division in Euclid, **Earl C. Barnes** serves as chief engineer of the company, **Karl H. Meyer** is manager of manufacturing services, and **Jonathan L. Collens** assumes position of assistant division manager of the Ivanhoe Division. In Ashtabula, Ohio, **Don E. Bouffard** is the manufacturing manager of the division, and **Ralph G. Davis** will serve as assistant division manager. **William R. Hough, Walter H. Haber,** and **Hugh D. Luke** recently were elected vice presidents of operations and **Richard A. Geuder** was elected vice president of marketing.

its working LIFE!



It's the *steel* in ACE drill bushings... *that makes the difference!*

When working life is doubled . . . bushing costs are cut in half! Fewer bushing changeovers add *bonus production savings!* That's why ACE drill bushings of new high-carbon chromium steel are being *specified exclusively* by cost-conscious tool men everywhere! Make a *working comparison* NOW with any other make bushing . . . and see "Positive Proof" that *the steel makes the difference!*

Write for the all new 1957 ACE Catalog and the name of your nearest distributor. DEPT. F-3

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CIRCLE INFORM-A-GRAM KEY NO. 179

MEN YOU SHOULD KNOW

John H. Diehl, assistant to the vice president in charge of Rockwell Mfg. Co.'s Power Tool Division, takes over as general manager of the recently expanded Bellefontaine, O., power tool plant.

◆

The appointment of **Thomas Oliphant** as master mechanic of both the Tool & Die and Stamping Divisions of Garland Mfg. Co., was revealed recently. He will be in charge of all engineering, estimating, processing, and die building activities at Garland.

◆

The new chief gage engineer of Freeland Gauge Co., is **William A. Minix.**

◆

Harvey L. Spaunburg, Jr. is serving as manufacturing manager of the Contract Sales Division of the Hartford Special Machinery Co.

◆

Appointment of **Joseph A. Richardson** as plant manager of the new Ford assembly plant at Lorain, Ohio, has been announced by the company.

◆

Lester D. Martin has been made vice president of the Oster Mfg. Co.

Two metallurgists have been promoted to new positions by the Carpenter Steel Co. **Basil T. Lanphier,** metallurgist for stainless and high temperature alloys, has been named manager of research. **Howard O. Beaver,** formerly plant metallurgist in melting, has been promoted to production metallurgist in charge of melting and hot working.

◆

The board of directors of Vinco Corp., has elected **Joseph S. Sherer, Jr.,** as president and board member.

◆

Kenneth P. Martin is serving as vice president and general manager of the LeMaire Tool & Mfg. Co.

◆

Lindberg Engineering Co., announces the appointment of **K. A. Lang** as general manager of the plant in Downey, Calif. He will also be responsible for sales activities of Lindberg Engineering Co. and Lindberg Industrial Corp., in Downey, San Francisco, Seattle, and Denver.

◆

New general superintendent of Minneapolis-Honeywell Regulator Co.'s new plant at Fall River, Mass., is **George W. Hoffmeister.**

The board of directors of Wheelabrator Corp. recently elected the following officers: **James F. Connaughton,** executive vice president; **Harold M. Miller,** senior vice president; **Jacob A. Schmidt, Jr.,** secretary-treasurer; **John M. Wolf,** controller; and **Edward T. Sullivan,** assistant secretary-treasurer.

◆

Dana Corp. announces promotions in the engineering department. **Ray Reed** is now chief engineer of the Railroad Division, **Norman Revenaugh** is the mechanical transmission engineer with **R. E. Fletcher** serving as his assistant, and **William Trisler** is the universal joint engineer. Also promoted were **R. R. Furney,** assistant chief engineer, Clutch Division, **M. M. Schall,** chief engineer of Hydraulic Transmission Division, and **Carl Gustafason,** assistant chief engineer, Mechanical Transmission Division.

◆

R. E. Tennery is now general superintendent of Link-Belt Co.'s Los Angeles plant. He was previously associated with the Seattle plant where he was also general superintendent.

YOU GET *SPEED* PLUS ACCURACY WITH MOORE JIG GRINDERS

HOLES from 1/64" to 8" Relocated and Ground within .0001" in One-Third Previous Time

Before hardening, this two-station die block was Moore-Jig-Bored to eliminate the need for excessive grinding. After hardening and surface grinding, all holes were Moore-Jig-Ground to exact size and location. Blank hole and center piercing hole were ground with ½° included taper. Little clearance could be allowed between punch and die. Jig grinding time: *only 2¼ hours.*

CONTOURS, Too, Accurately Jig Ground and Checked in One Setting

This flanged punch, impractical to grind by any other method, was a natural for the No. 2 Moore Jig Grinder. All radii—male and female—were ground accurately to location and size. The piece, having been set up on a rotary table, was aligned to permit grinding of the angular surfaces. And the entire contour was inspected by the "indicator measuring" method while the punch was still on the machine.

The word "versatile" must have been coined for the No. 2 Moore Jig Grinder. Not only does this machine relocate and grind straight and tapered holes with ease, but it contour grinds, chop grinds and slot grinds just as skillfully.

The Moore Jig Grinder, together with its toolroom teammate, the Moore Jig Borer, enables tool and die sections to be produced concurrently, puts diemaking on an interchangeable-parts-and-assembly basis. And it's also a time-saver on production jobs.

Employing the accurate lead screw measuring principle and a convenient system of coordinate hole location, the fast and sure Moore Jig Grinder eliminates hours of checking on bench and surface plate.

Why not find out how this remarkable machine can save *you* sizeable chunks of time and money. Write today for our detailed bulletin.

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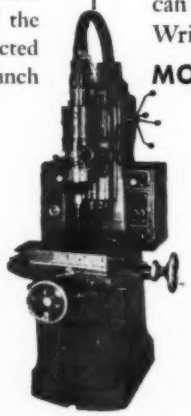
"HOLES, CONTOURS AND SURFACES
is bound to become a classic to the man or shop that does accurate work."
American Machinist Book Review
424 pages — $5 U.S.A., $6 elsewhere



NO. 2 MOORE JIG GRINDER
Range 10" x 16" x 16" height. Grinding speeds from 12,000 to 60,000 rpm. Infinite feeds up and down; spindle-housing heat control. Features slot grinding attachment.

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

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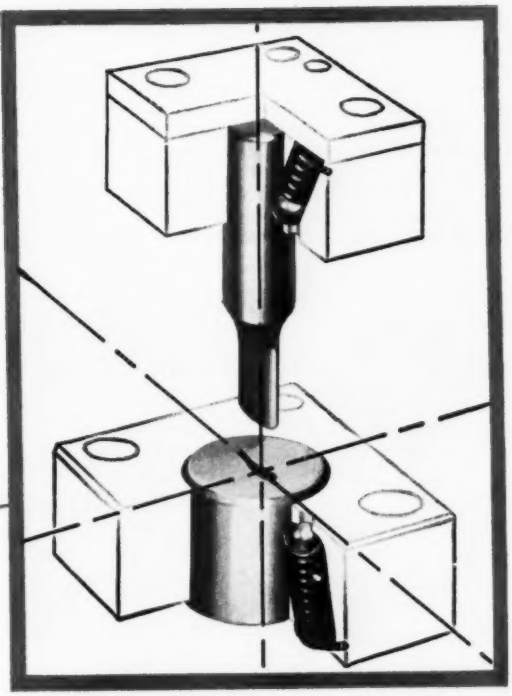
WHY R-B Punches are easier to use



Just a push, a twist, and "click" your R-B punch or die button is accurately ALIGNED and LOCKED in place. The R-B ball lock prevents radial or vertical movement of the punch or die button in the retainer—no additional keying is required. R-B punches and die buttons are just as easy to remove —simply insert tanged tool in retainer hole to release ball lock. Standardized and completely interchangeable in any shape or size, these easy to use punches and die buttons save your time and energy.

No other manufacturer of punches and die buttons can offer you the amount of successful application experience and the scope of knowledge that is available from the R-B engineering staff for:

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- ★ Reducing Die Designing Time
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CIRCLE INFORM-A-GRAM KEY NO. 181

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PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Surface Equipment for tooling and production operations in metal-working and welding shops are described in a catalog. Included is complete information on the three point suspension surface plates, magnesium and semi-steel straight edges, parallel straight edges, and dove-tailed straight edges. Catalog 823 is supplied by The Challenge Machinery Co., Grand Haven, Mich., or —
Circle Inform-A-Gram No. B1.

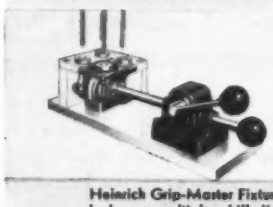
A Line of 2" Dia Shank End Mills are featured in an illustrated bulletin which gives complete listing of four different style heavy duty end mills used in such operations as tracer-controlled milling. A description of an adapter for these end mills and other different types of end mills are included. Copies of Bulletin C 20 are now being distributed by Brown & Sharpe Mfg. Co., Providence, or —
Circle Inform-A-Gram No. B2.

heinrich Grip Master VISES
with exclusive "CIRCLE-GRIP" LOCKING MECHANISM
The fastest—safest—most accurate line of screwless type holding devices ever offered to industry.

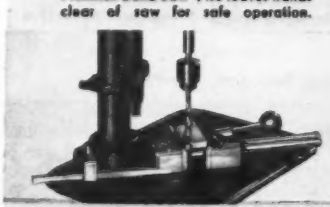
The Grip Master drill jig, shown in the above illustration, cost a Heinrich customer $60.00. Original drill jig design was estimated at $250.00. This is just one example of how you too can cut tooling costs with the Heinrich jig and fixture formula.

Sets and Locks in a flash!
Speedy loading and unloading cuts production costs.

4 GREAT GRIP-MASTER WORK SAVERS


Heinrich Grip-Master Fixture lock on multiple drill jig.

Heinrich Band Saw Vise leaves hands clear of saw for safe operation.


Heinrich Safety Drill Vise increases production with accuracy.

The Grip-Master Fixture locks make jig and fixture designing easier—does away with locking details and troublesome clamps.

Tool steel cuts faster, safer when locked in the grip of a Heinrich band saw vise. Unlike other Heinrich Vises guide bar is of soft cold roll steel to prevent damage to saw blade—shoulder screws are removable for chain feed.

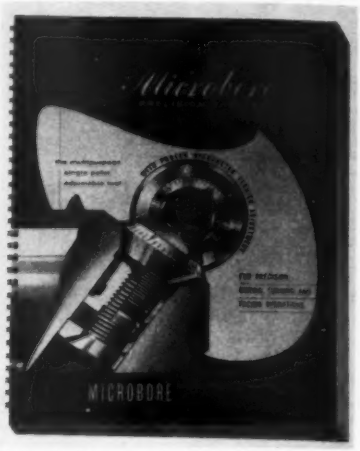
Heinrich Safety Drill Vise, with built-in recessed parallels, holds work square. Vertical V-groove provides positive grip on rounds—table mounting attachment does away with clamps, straps, and adapters. Vise cannot swing off table.

Write for free catalog—learn how Heinrich Grip-Masters can cut tooling costs.

HEINRICH TOOLS, INC., Dept. 137J, Racine, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 182

332 Standard General Purpose Boring Bars are listed in the Microbore catalog. The comprehensive catalog presents a range of designed standard single tool and two tool boring bars, boring bar sets, and accessories.



It includes complete application, dimensional, and carbide data. In addition there are simple engineering illustrations and flip charts. Direct requests for Catalog 58 to DeVlieg Microbore Div'n, DeVlieg Machine Co., 2720 W. 14 Mile Road, Royal Oak, Mich., or —
Circle Inform-A-Gram No. B3.

A 22-Page Brochure on pure metals, master alloys, and ferro alloys is of interest to metallurgists and design engineers who are concerned with heat resistant alloys, abrasion resistant materials, and with new alloys for extremely severe processing conditions. The brochure covers various grades of chromium metal, chromium molybdenum, ferro alloys, tungsten melting base alloy, zirconium aluminum, and vanadium aluminum. Complete chemical analysis and powder mesh sizes are listed. Copies of the Alloys brochure are available from Shieldalloy Corp., Newfield, N. J., or —
Circle Inform-A-Gram No. B4.

Used for Long or Short Runs and easily set up for turning, boring, or facing is a precision boring machine described in a catalog. Other features include permanent lubrication, single control for stop, feed, and rapid traverse, motor is insulated from spindle housing, etc. Specifications of this machine and illustrations are also included. For your copy of Catalog CO-5705 write to Jones & Lamson Machine Co., Clinton St., Springfield, Vt., or —
Circle Inform-A-Gram No. B5.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

A 4-Page Brochure on Dow Corning 44 grease, one of the all silicone-based lubricants, has been released. Developed originally for high-speed, high-temperature bearings, its resistance to oxidation gives practically lifetime lubrication for ball bearings for industrial motors, ball and socket disconnect switches, swivel joint packings. These, plus a variety of heavy-duty industrial applications, are discussed and illustrated along with tables and other data on properties and performance. Write to Dow Corning Corp., Midland Mich., for a copy of Brochure 6-209, or —
Circle Inform-A-Gram No. B6.

10" Quills and 50 HP Motor in all 4 heads are features of the Hydro high speed planer type milling machines which are outlined in Bulletin 108. Another feature is in the improved table drive which eliminates backlash on climb milling jobs. Illustrations and a detailed specification chart are also included in the bulletin. Copies may be obtained from Giddings & Lewis Machine Tool Co., Fond Du Lac, Wis., or —
Circle Inform-A-Gram No. B7.

Parts, Principles, and Applications of Hoffman centralized filtration systems are described in a 4-page brochure. Discussions about the systems are presented in addition to the illustrations. Simplified drawings are included of typical central filtration system. Write to U. S. Hoffman Machinery Corp., 105 4th Ave., New York 3, for your copy, or —
Circle Inform-A-Gram No. B8.

"Ideas in Material Handling" is an illustrated bulletin which outlines the solution to problems of moving materials. Trambeam Monorail Systems provide fast point-to-point transportation and will handle loads up to 15 tons. Other advantages of this time and space saving device are presented. Copies of Bulletin M-32 are released by Whiting Corp., 15650 Lathrop Ave., Harvey, Ill., or —
Circle Inform-A-Gram No. B9.

A Comprehensive Catalog lists and describes precision adapters, tap drivers, bearings joints, etc. Pictures and diagrams accompany each section of tools. Specifications are given in table form and advantages and features are also included. Copies of the catalog are published by Seibert & Sons, Inc., Chenoa, Ill., or —
Circle Inform-A-Gram No. B10.

A Portable Precision Machining Tool, Dumore Versa-Mil, is featured in a catalog. Included is information on how to use the basic unit and seven attachments, with over 35 specific application photos, for milling, boring, shaping, slotting, grinding, drilling, and dozens of other related machining operations. Catalog VM-57 are released by The Dumore Co., 1300 17th St., Racine, Wis., or —
Circle Inform-A-Gram No. B11.

A Bulletin containing standards of cutters for die sinkers, and tool makers is offered by the Tomkins-Johnson Co., Jackson, Mich. The catalog discusses the type of metal used and gives illustrations with each list of specifications. An index quickly locates end mills, angle cutters, roughing cutters, and other tools. Write to the company for a copy of Catalog 1055, or —
Circle Inform-A-Gram No. B12.

2548

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this
DIE-PART PORTELVATOR®
(OR AN ENGINEERED VARIANT)
will speed your work
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Top plate raises and lowers for fitting operations
and rotates 360° to give easy access to die.

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"We grind no axe . . . and really have no need to." After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

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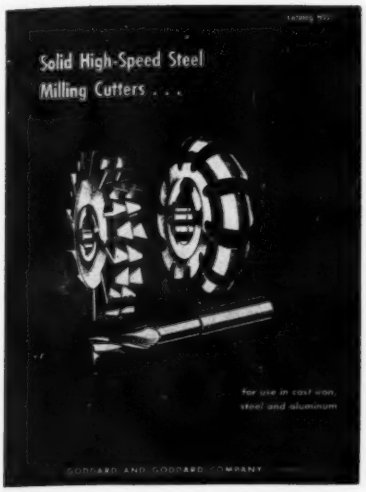
100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE

CIRCLE INFORM-A-GRAM KEY NO. 184

49 Types of solid high-speed steel milling cutters designed for machining aluminum, light metal alloys, and ferrous materials are described and illustrated in a catalog. The 32-page



publication contains complete specifications for each cutter and accessory tool holders. Direct inquiries to Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, for copies of Catalog HSSS-1, or —
Circle Inform-A-Gram No. B13.

Shurclose Caps and Plugs are featured in a catalog prepared by the Shurclose Seal Company, 3000 E. Grand Blvd., Detroit 2. Complete specifications are given for both rubber and plastic closures for the protection, sealing, or masking of threaded parts, pipe ends, or tubing. Seven styles of stock sizes are covered by the specifications. For your copy of the Catalog 57-4 write to the company, or —
Circle Inform-A-Gram No. B14.

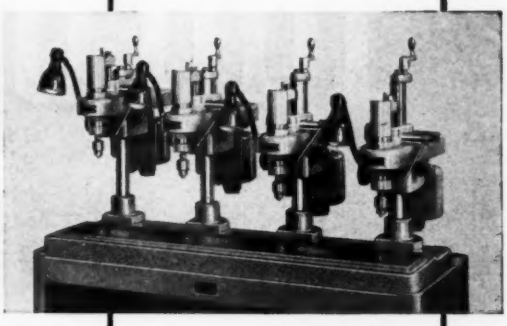
Multi-Slide Machines for the automatic production of precision formed stampings are featured in a catalog which contains specifications for four sizes of machines. Information on auxiliary attachments and examples of typical applications are also included. Direct requests for copies of Bulletin 15 to U. S. Tool Co., Inc., Ampere, N. J., or —
Circle Inform-A-Gram No. B15.

Specifications of Dowel Pins are given in a catalog which lists sizes for both bulk and packaged pins. The catalog outlines standard and oversize pins and in addition, lists the special sizes available. All pins are tolerance ground to ±0.0001". For your copy of Catalog 727A write to Precision Steel Warehouse, Inc., Downers Grove, Ill., or —
Circle Inform-A-Gram No. B16.

An 8-Page Tool Catalog features the new line of tube working tools which has been added to a line of brass and steel tube fittings, hydraulic hose, hose ends, and assemblies. It illustrates and describes tools for flaring, burnishing, double flaring, cutting, bending, and joining copper and steel tubing. Complete instructions and specifications are included for each. Copies of Catalog 6111 are available from The Weatherhead Co., 128 W. Washington Blvd., Fort Wayne, Ind., or —
Circle Inform-A-Gram No. B17.

Design Features and Specifications for a line of standard flexible shafts for solving a wide variety of power transmission and remote control problems are described and illustrated in a bulletin. Shaft components, such as inner shaft, neoprene casing, and female couplings at each end, are discussed. Specifications, torque loads, drive speeds, and similar data are given for each of the six models. Bulletin 5608 is furnished by S. S. White Industrial Div'n, 10 E. 40th St., New York 16, or —
Circle Inform-A-Gram No. B18.

HAMILTON
SUPER SENSITIVE, SMALL-HOLE
PRECISION
REPEAT
PRECISION
DRILLING MACHINES



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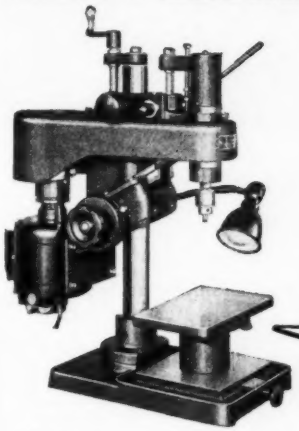
SINGLE OR MULTIPLE SPINDLES • VARIOUS CAPACITIES • WIDE RANGE OF CLEARANCES • VARIABLE SPINDLE SPEEDS • COMPANION TAPPING MACHINES



Designed and built to *master* the heart-breaking jobs which are so often attempted on drilling machines of "standard" accuracy.

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IT'S A Hamilton Tool
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2467

CIRCLE INFORM-A-GRAM KEY NO. 185

Selective Speed and Power is a feature of the Thurst-O-Matic dual-cycle hydraulic cylinder outlined in a bulletin. Applications and operation of this machine are described. A detailed simplified drawing of the Thrust-O-Matic is presented along with views of the operation of the cylinder. Included also is a section explaining the principle of operation and the construction. Copies of this bulletin are issued by Crown Engineering Corp., 4700 Washington Ave., Houston 8, Texas, or —
Circle Inform-A-Gram No. B19.

"Cincinnati Centertype Grinding Wheels" describes the many features and applications of these wheels. Catalog PG-341 is illustrated and also contains a table of suggested grinding wheel gradings for various centertype grinding operations. In addition to grinding wheels for production, there are grinding wheels for toolroom and general purpose work. Copies of Catalog PG-341 can be obtained from Cincinnati Milling Products Div'n, The Cincinnati Milling Machine Co., Cincinnati 9, or —
Circle Inform-A-Gram No. B20.

57-97

Proof of Precision: This 100,000th Spindle

. . . that's right. Ex-Cell-O has produced more than 100,000 precision grinding and boring spindles. They are in use today throughout the world, on a wide variety of important jobs. No other spindle manufacturer has so solid a record for satisfaction—so sound a reputation for building the best.

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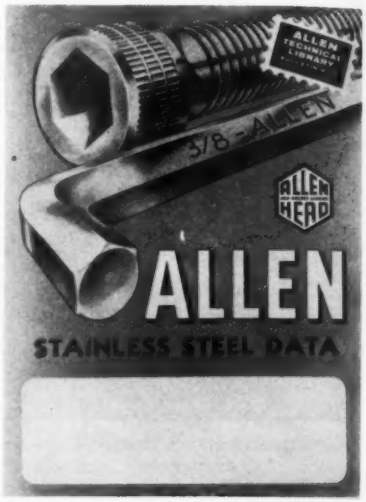
EX-CELL-O CORPORATION Machinery Division
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE INFORM-A-GRAM KEY NO. 186

"Stainless Steel Data" has been issued by The Allen Mfg. Co., Hartford 2, Conn. Characteristics of the three major types of stainless steels are outlined, together with their advantages in various kinds of applications. In a reference table, characteristics of these stainless steels at



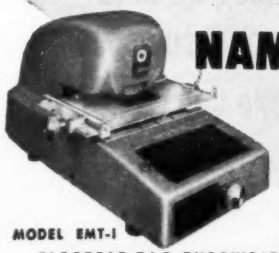
elevated temperatures are detailed as to strength and toughness, scale resistance, grain growth and structural changes, and corrosion resistance. Copies are supplied by the company, or —
Circle Inform-A-Gram No. B21.

Additions to the Line of Carbide Tools are listed in a catalog. Included are chatterless countersinks, solid carbide center laps, and solid carbide flute chucking reamers. The catalog shows extended ranges in end mills, also twist drills in straight shank fractional sizes. Direct requests for copies of Catalog 57 to Super Tool Co., 21650 Hoover Rd., Detroit 13, or —
Circle Inform-A-Gram No. B22.

Vibratory Feeder Base Units with independent control panels are explained in an illustrated catalog. Also, included are blank cast bowls and fabricated supply hoppers. In addition to specifications and diagrams, the catalog discusses the advantages and features of these products. Direct request for copies of Catalog 5742 to Vibratory Feeder Co., Erie, Pa., or —
Circle Inform-A-Gram No. B23.

Models in The 1000 Standard Line of valves and cylinders are outlined in a folder. Cross-sections illustrate and describe each type of air or hydraulic valve and cylinder. Photographs and line drawings of functional flow valves are also presented. "The Complete Line" is supplied by Rivett, Inc., Brighton 35, Boston, or
Circle Inform-A-Gram No. B24.

CUT PRODUCTION COSTS!
MARK
NAME PLATES
5 TIMES FASTER



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ELECTRIC TAG TYPEWRITER
A touch of the finger delivers up to 2 tons pressure for deep, legible impressions in metal or plastic tags.

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HI-SPEED
TAG MARKING MACHINE
Automatically marks BOTH constant and serial numbers at any desired speed up to 8,000 tags per hour!
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CIRCLE INFORM-A-GRAM KEY NO. 1871

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Satisfaction Guaranteed Or Money Back TRIAL OFFER

TRU-O-SEAL Fittings are guaranteed to seal pipe thread connections permanently against all oils, practically all known chemicals and gases; to seal under high pressures or vacuum; to withstand —280° to plus 500° F.; to eliminate "overtightening" damage and pipe dope. Available in ⅛" to 2½" pipe thread sizes.

$10.00 Trial Offer No. 1: eight ⅛", ten ¼", eight ⅜", ten ½" pipe thread TRU-O-SEAL Fittings.

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Flick-Reedy Corp
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"Miller Fluid Power" is also a Div. of Flick-Reedy Corp.

1 Thread TRU-O-SEAL on pipe or fitting (no messy pipe "dope" needed). SEAL SIDE

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3 Tighten TRU-O-SEAL to complete leakproof assembly (only light torque required).

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Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.

A five station indexing fixture from Vulcan's Contract Tool Room (Your tool room in Dayton).

Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts and of course hours of time.

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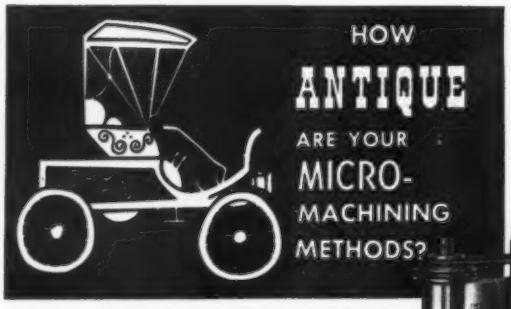
VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 1873



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SMALL DRILLS MUST BE HELD IN PRECISION COLLETS TO ASSURE ACCURACY

LEVIN ® MICRO-DRILL PRESS

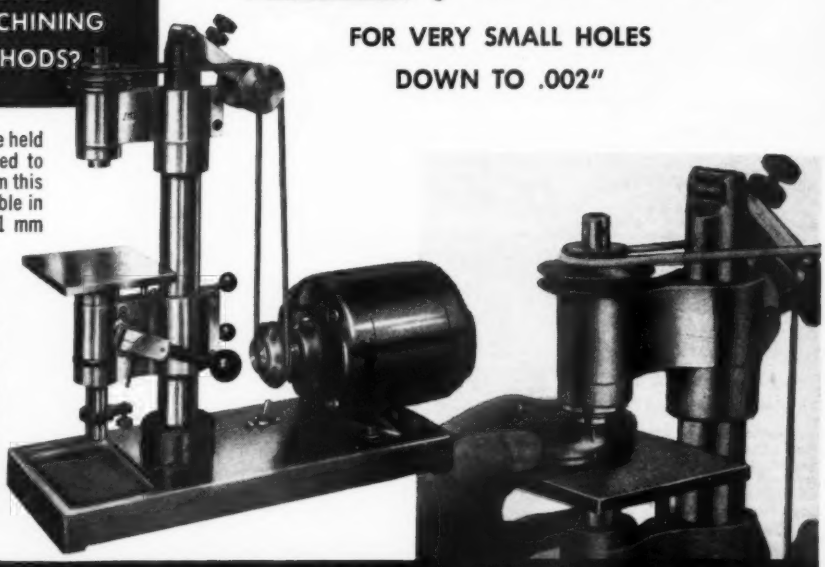
FOR VERY SMALL HOLES DOWN TO .002"

In the LEVIN micro-drill press drills are held in precision collets. Runout is reduced to practically zero and drill breakage from this cause is eliminated. Collets are available in a complete range of sizes down to .1 mm (.004").

SPECIFICATIONS:

Size of table is 3-3/4" x 4". Maximum table travel is 1-1/2". Greatest distance between table and end of spindle 4". Preloaded ball bearing spindle with four speeds 1725, 2600, 3000, 4700 RPM. Motor 1/2 HP, 110V, 60C. The micro-drill press may also be had with a 3450 RPM motor, doubling the above speeds.

Send for catalog M describing complete line of micro-drilling equipment, collets, instrument lathes and precision tools.



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CIRCLE INFORM-A-GRAM KEY NO. 1881

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COMPLETE DETAILED SPECIFICATIONS
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CIRCLE INFORM-A-GRAM KEY NO. 1882

SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

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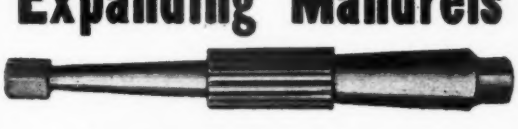

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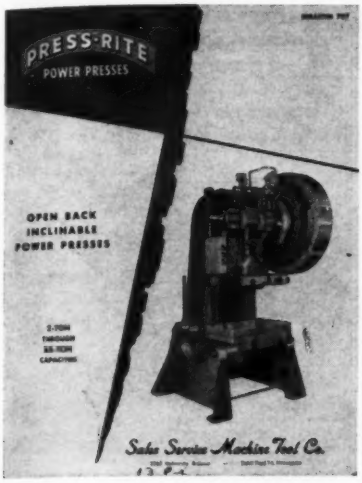
If it's made by **Lee** *it's a* **"Knock-Out"**

CIRCLE INFORM-A-GRAM KEY NO. 1884

Two Single Back Geared Presses of 30-ton and 37½-ton capacities are included in a catalog showing the complete line of 2-ton to 85-ton Press-Rite OBI power presses. Instructions and descriptions of all



presses and press features with complete specifications are presented. Get your copy of Bulletin 757 from Sales Service Machine Tool Co., 2351 University Ave., St. Paul W14, Minn., or—**Circle Inform-A-Gram No. B25.**

A line of V40 Mounted Wheels in industry standard shapes and sizes and in a complete range of gradings to meet all precision grinding requirements has been announced by Bonded Abrasives Div'n, The Carborundum Co., Niagara Falls, N. Y. A folder lists the shapes, dimensions, and other specifications, and diagrams of the products accompany the material. Copies of the folder can be obtained from the company, or — **Circle Inform-A-Gram No. B26.**

A Conversion Chart for standard jig and fixture components has been prepared by Northwestern Tool & Engineering Co., 116 Hollier Ave., Dayton 3, Ohio. This is a cross reference chart for identical items which can be supplied by eight manufacturers of job and fixture components. Copies of this chart are being distributed by the company, or—
Circle Inform-A-1ram No. B27.

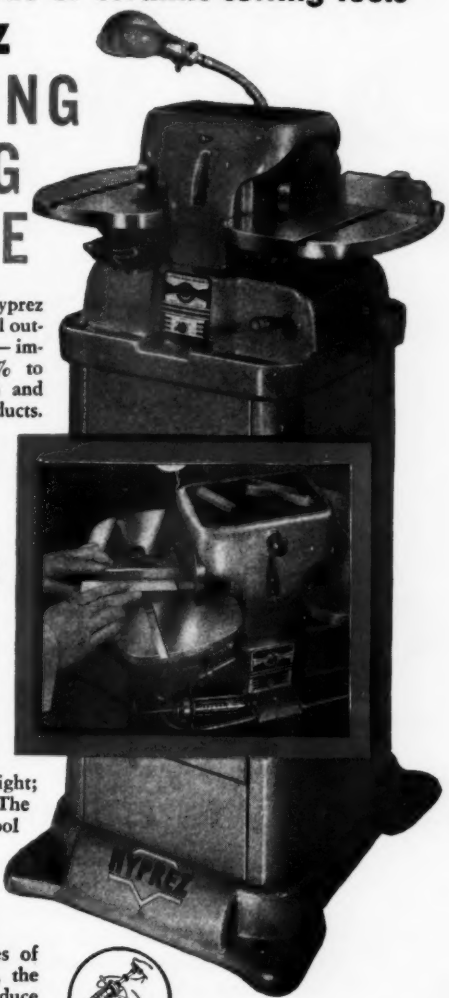
"Get the Hole Story" contains information on a line of turret lathe drill speeders. The catalog gives specifications, advantages, and features of the drill speeders. There are several models to fill every need and for use with different turret lathes. Direct requests for copies of Catalog A-8 to the Ward-Riddle Co., Ravenna, O., or —
Circle Inform-A-Gram No. B28.

Controlled-Penetration End Mills are the subject of a leaflet which describes economies to be gained and lists types and sizes available, ranging from ⅜" dia to 1-1½" dia. These end mills employ staggered notches in the cutting edges which produce lobes in the work at the point of cut. These lobes tend to draw the following cutting edges into the work, thus forcing them to take a uniform bit with a minimum of deflection. The DoAll Co., Des Plaines, Ill., supplies copies of the leaflet, or —
Circle Inform-A-Gram No. B29.

A 12-Page Catalog containing detailed descriptions of Wheelabrator rooms has been published by Wheelabrator Corp., 1183 S. Byrkit St., Mishawaka, Ind. Photographs show examples of all types of rooms being used for the specific cleaning application for which they were designed. Also included are descriptions of spinner hanger cabinets, twin tables, double door swing tables, and swing tables with airblast touchups. Write to the company for copies of Catalog 142-D, or —
Circle Inform-A-Gram No. B30.

Increased output from your carbide or ceramic cutting tools

HYPREZ
OSCILLATING LAPPING MACHINE



Records prove that the Hyprez lapping technique increases tool output per grind 200% to 700% — improves speed and feeds 50% to 400% — assures finer finishes and closer tolerances on end products. Now, your carbide and ceramic cutting tools and inserts can be lapped or refinished precisely and quickly.

OSCILLATING WHEELS ASSURE PRECISION

The Hyprez Finisher moves the variable-stroke lapping wheel across the edge of the tool while it is held stationary in a precisely controlled position. Protractors set exact angles for the horizontal and vertical planes; edges are straight; the geometry is not distorted. The top, lands and radii of the tool can be finished to 1 micro inch in two minutes or less.

HYPREZ DIAMOND COMPOUNDS

Charged with proper grades of Hyprez Diamond Compounds, the oscillating lapping wheels produce uniform, predictable finish—faster, scratch-free, precise.

For a demonstration or complete literature write Dept. LST-107

HYPREZ DIVISION
ENGIS EQUIPMENT CO.
431 S. DEARBORN ST., CHICAGO 5, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 189

Rol-Di-Feed, self-contained cam operated units, are the subject of a booklet which explains the operation and principles of the 9" and 12" units. They require no connection to the crankshaft of the press, and the open side design permits feeding a broad range of material widths and will handle coiled stock up to ¼" thick. Also included are specifications, features, and applications. Copies of the bulletin are published by H. E. Dickerman Mfg. Co., 321 Albany St., Springfield, Mass., or —
Circle Inform-A-Gram No. B31.

A 12-Page Catalog describes a Hydro-Way unit for heavy duty drilling, reaming, spotfacing, boring and counterboring, milling, and chamfering. The unit may be mounted horizontally, vertically, or on an angle. Other features of this unit and the specifications are included. Simplified diagrams show the machine's operation as it advances, feeds, dwells, and returns. Bulletin 357 has been announced by The Avey Div'n, Motch & Merryweather Machinery Co., Box 625, Cincinnati 1,
Circle Inform-A-Gram No. B32.

FAST DEPENDABLE DELIVERY*

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LINCOLN GAGE CO.

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Teletype ROSEVILLE 834

CIRCLE INFORM-A-GRAM KEY NO. 190

Mechanical Gap Presses from 75- to 500-ton capacities are illustrated, and detailed specifications are given in a 16-page catalog. Design details are included as well as photographs

of gap press installations. In addition, special models and other products are described. Copies of Catalog GP-57 are available from Verson Allsteel Press Co., 9300 S. Kenwood Ave., Chicago 19, or —
Circle Inform-A-Gram No. B33.

A New Splining Attachment for the Morrison 1" keyseater, jig bored for extreme accuracy, is discussed in a catalog. Advantages and features of this product are outlined and illustrations accompany the material. In addition to a list of specifications, the recommended tool post for certain widths of keyways are given. Copies of Bulletin 714-A are being distributed by the D. C. Morrison Co., P. O. Box 1017-T, Cincinnati 1, or —
Circle Inform-A-Gram No. B34.

A Pocket Edition of the Guide to standard barrel, bar, and indicator flush pin gages has been released by the Union Gage Corp., 710 Lehigh Ave., Union, N. J. It contains drawings and specifications on more than 150 gages. All non-gaging surfaces are black oxidized to prevent rusting, and all gages are finished to individual specifications. The guide can be obtained by writing to the company, or—**Circle Inform-A-Gram No. B35.**

Bushing Types and Sizes, drill sizes with their decimal equavalents, concentricity of bushings, and Rockwell hardness are given in a catalog. It consists of three connected information pages folded so all technical data can be seen easily. More standard bushing sizes have been added. Copies of this catalog were prepared by American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, or —
Circle Inform-A-Gram No. B36.

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DRESEL-BETZ CO.
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Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

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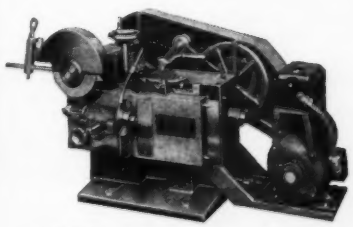
This Investment PAYS OFF

Automatic Metal Saw Grinder Cuts Cost
. . . Makes Money For You!



Wardwell's "35-T" will sharpen up to 115 saws .015 thick at one time. This includes slitting and screw slotting saws and milling cutters. Takes saws from 2" to 5½" diameter. Completely automatic. No attention is required after machine is started. These ingenious, compact and sturdy grinders are saving and making money for their owners all over the world.

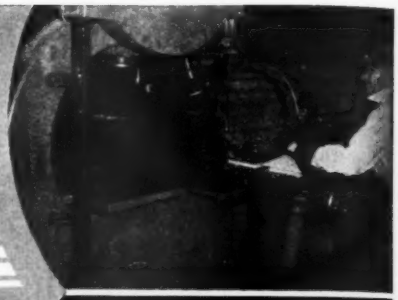
WARDWELL
3809 Ridge Road
Cleveland 9, Ohio

Write for Bulletin 35T

Maker of Largest Line of Saw and Tool Sharpening Machines

CIRCLE INFORM-A-GRAM KEY NO. 1912

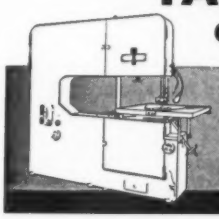
FRICTION SAWING with Tannewitz HIGH SPEED BAND SAWS



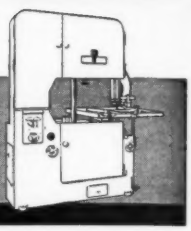
FASTEST, BEST MEANS OF CUTTING METALS

If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS
GRAND RAPIDS, MICHIGAN ☎ GL-6-1729



TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market.
Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 1921

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Standard sizes 00, 0, 2, carried in stock.

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AIR-POWERED TOOLMAKERS VISE
UNIVERSAL DOUBLE SWIVEL

Can be adjusted to any position without removing work from jaws. Furnished with hardened steel jaws and brass caps. Operated by a 6" air cylinder manufactured by Yost. Control kit included with each vise consisting of foot treadle valve, quick exhaust valve and 2 lengths of coupled hose. Jaws can be pre-set to any desired opening. Vise can also be operated manually. Jaw width — 4"; jaw opening — 6"; approx. wt. — 90 lbs.

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YOST MFG. CO., Cambridge Springs, Pa.

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GAGE BLOCKS,
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Prompt, Economical Inspection Service

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CIRCLE INFORM-A-GRAM KEY NO. 1924

A 32-Page Catalog covers a line of Dimensionair air gages and accessories. Included is an expanded listing of air plugs, counter bore, and blind hole models. A chart shows how gaging ranges are apportioned

on the Dimensionair's calibrated scale with relation to size of workpiece dimension and its tolerance. For your copy of Catalog 57D write to Federal Products Corp., 1144 Eddy St., Providence 1, or —
Circle Inform-A-Gram No. B37.

The New Edition of The General Catalog and engineering manual has been published by the Aetna Ball & Roller Bearing Co., 4600 Schubert Ave., Chicago 30. A line of sealed, pre-lubricated ball bearing package units is outlined. These units are used in applications with stationary flange-type housings. The 88-page publication includes engineering data on how to calculate thrust load capacities for any speed, how parallelism and flatness affect thrust bearing performance, etc. Write to the company for your copy, or —
Circle Inform-A-Gram No. B38.

Protect Cutter Blades in transportation, normal handling, and storage with Cy-Co-Trol cutter guards outlined in a bulletin. Other advantages and features of the cutter guards are described, and illustrations show different ways of handling and storing the cutters. In addition to guards for cutters from 4" to 20" dia, special orders can be filled for guards for cutters of larger diameter, cut-off saws, or special shaped cutters. For your copy of the Cy-Co-Trol cutter guard bulletin, write to Royal Design and Mfg. Inc., 4133 E. Ten Mile Rd., Center Line, Mich., or —
Circle Inform-A-Gram No. B39.

A Revised Bulletin contains up to date technical information relative to arc welding with bronze electrodes, filler rod and wire. Bulletin W-17 presents data on the Ampco-Trode 40 electrode and Braz 1, 2, and 3 filler rods. Described are welding procedures, techniques and processes, recommended welding currents, typical applications, and a comprehensive electrode and filler rod selection and preheat chart. Copies of Bulletin W-17 are released by Ampco Metal Inc., 1745 S. 38th St., Milwaukee 46, or—**Circle Inform-A-Gram No. B40.**

Features of the Brehm "Shimmy" Trimming Dies are outlined in an illustrated catalog. A brief description of the construction and action of the die is shown in simplified illustrations. Specifications and advantages are given for standard design dies and other products. One basic die with 8 different sets of cutting members can be used to trim 8 parts of different shapes. For your copy of this catalog write to Vulcan Tool Co., Brehm Div'n, 730 Lorain Ave., Dayton 10, O., or —
Circle Inform-A-Gram No. B41.

12" Swing No. 2525-V
Logan Screw Cutting Lathe

Brief Logan Lathe Specifications
SWING, 14½" down to 9" . . . CENTERS, 40" to 17" . . . COLLETS, 1" to ½" . . . SPINDLE BORE, 1⅜" to 25/32"

Advanced Design Features
Ball Bearing Headstock . . . Variable Speed Drive on larger models . . . Double V-Belt Drive on smaller models . . . Automatic Safety Gear . . . Precision Carriage . . . 2-V-way, 2-flat-way precision ground bed, furnished flame hardened at small additional cost.

■The Automatic Safety Gear neutralizes sudden overload shocks, automatically disengaging if the carriage or tool jams up, and thereby reduces breakage to all gears from the spindle through the quick change gear box and into the carriage. It is furnished as standard equipment with all Logan 12" and 14" lathes and may be ordered installed on new Logan 9", 10", and 11" lathes. The Automatic Safety Gear can be furnished for any quick change gear Logan Lathe already in your shop at a price of $10.00 for 9", 10", or 11" lathes and $15.00 for 12" or 14" lathes.

The safety gear typifies Logan advanced design and thorough construction. The Logan ball bearing spindle, variable speed drive, precision carriage and rugged, accurate bed are further reasons why you can depend on a Logan Lathe for exacting high speed production and second operations. Ask your Logan dealer for details, or write for the Logan catalog.

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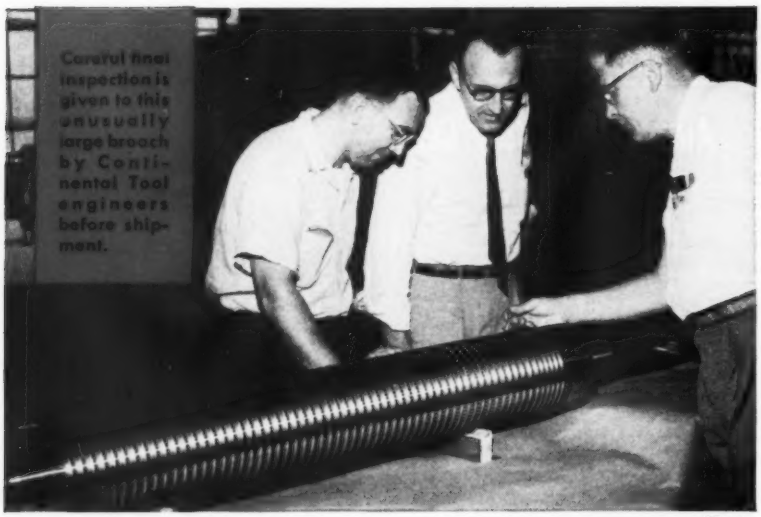
CIRCLE INFORM-A-GRAM KEY NO. 193

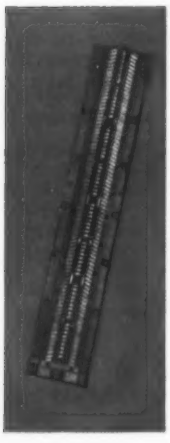
A Line of Power-Grip Control Units for 7 sec demagnetization of low-voltage magnetic chucks is described in a bulletin. Three types of control units in this line are available for a broad range of applications. All the physical dimensions, d.c. outputs, and other essential information on all of the 21 models are summarized in a table. Copies of the bulletin are made available by Sundstrand Magnetic-Pneumatic Products Div'n, Sundstrand Machine Tool Co., 1020 9th St., Rockford, Ill., or —
Circle Inform-A-Gram No. B42.

Erectomatic Steel Shelving is detailed in a 4-page bulletin. It features a built-in shelf-locking device for faster erection and subsequent disassembly and repositioning. Illustrations show the unique locking action and other time-saving construction features that permit straight in and out shelf change and full use of shelf area. The shelving comes in regular, medium, heavy, or extra heavy construction. For copies of the bulletin contact Standard Pressed Steel Co., Box 600, Jenkintown, Pa.
Circle Inform-A-Gram No. B43.



57-15

Ever see a broach this large before?



This mammoth broach accurately broaches involute splines in steel for a builder of earth-moving equipment. Built by Ex-Cell-O's Continental Tool Works Division, it called for a series of critical manufacturing operations, including a difficult hardening process applied to the shell main body . . . another good example why it pays to call in your local Ex-Cell-O Representative when you face an unusual broaching problem.

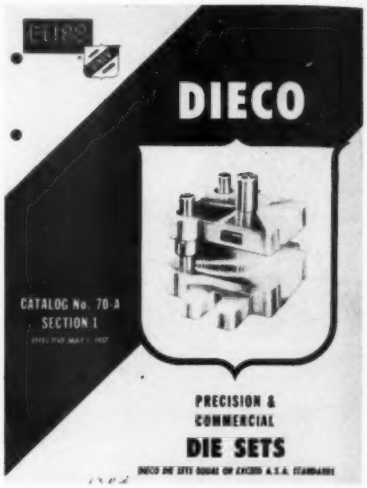
Just one of the many other types of broaches built by Continental.

Continental CTW TOOL WORKS

Division of Ex-Cell-O Corporation
DETROIT 32, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 194

Precision and Commercial Die Sets are highlighted in a catalog released by the Die Supply Div'n of E. W. Bliss Co., 1400 Brookpark Rd., Cleveland 9. The 20-page catalog is illustrated and contains sizes, dimensions, and other ordering data for a



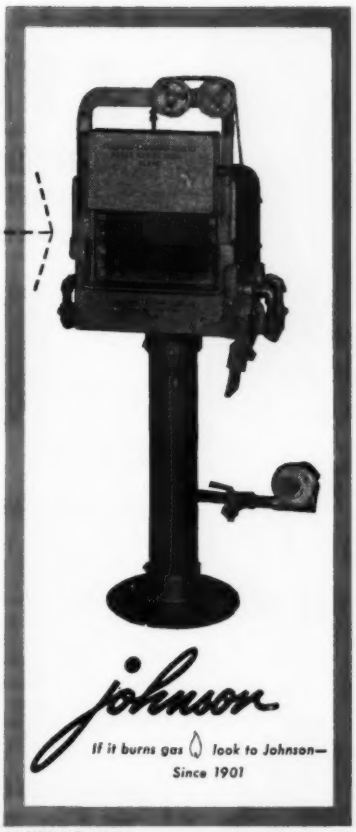
full line of die sets, both the standard two pin series and the rear two pin rectangular series. Contact the company for a copy of Catalog 70-A., Section 1, or —
Circle Inform-A-Gram No. B44.

A 6-Page Brochure Describing a Line of precision tool room and production grinders is available from Reid Bros. Co., Inc., Beverly, Mass. The literature also describes various accessories and attachments available for use with the equipment. Specifications and features of these products are also given. For copies of Bulletin 618, write to the company, or—**Circle Inform-A-Gram No. B45.**

Abrasive Mounted Wheels are the subject of an illustrated catalog. All sizes and shapes in the A and B series are pictured in actual size with dimensions indicated. Typical shapes of the W series with complete listing are included. Also shown are the new standard suffix designations for mandrel projections and diameters. Bulletin ESA-67 is supplied by Simonds Abrasive Co., Tacony & Frales Sts., Philadelphia 37, or —
Circle Inform-A-Gram No. B46.

A Reciprocating Gear Grinding Machine is featured in a catalog offered by The Sheffield Corp., Dayton 1, Ohio. Model 140 is discussed and illustrated, and the advantages of this product are listed. The catalog also points out the grinding operation and the different parts of the machine. Specifications, standard, and extra equipment are included. Copies of the catalog are available from Sheffield, or —
Circle Inform-A-Gram No. B47.

HEATS FAST SAVES TIME



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Start heat treating high speed and carbon steels while other furnaces warm up. Powerful burners in this efficient furnace get heat up to 1300°-2350° F. range in minutes. Temperatures accurately and quickly regulated. Ratchet-operated door opens upward — no need to open fully every time. High temperature refractory-lined firebox keeps heat uniform — 7" by 13" by 16½". 200,000 BTU's per hr. Carbofrax hearth, G.E. Motor and Johnson Blower included ..... F.O.B. Factory $358.00

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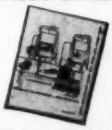

Johnson Gas Appliance Company
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CIRCLE INFORM-A-GRAM KEY NO. 1951

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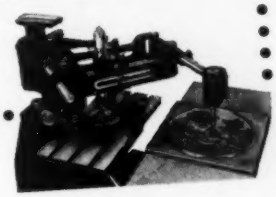
in steel, other metals and plastics



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- **Reversible spindle for enlarging or reducing from a model, die or sample**
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- **Micrometer adjustment collar**
- **Provided complete with floor stand and work tables**

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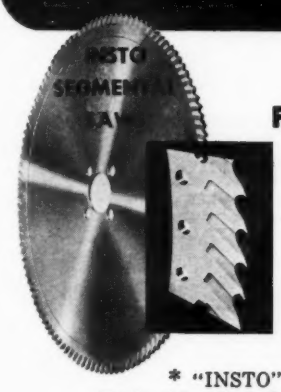
CIRCLE INFORM-A-GRAM KEY NO. 1953

CRAFTED IN SHEFFIELD* FOR MORE CUTS PER DOLLAR



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- "INSTO" Segmental Saws Available from 11" through 72"
- Cost less because of greater production
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* "INSTO" segmental Saws are produced in Sheffield, England by Firth Brown Tools, Ltd., an internationally famous name in metalworking. They are serviced in Cleveland in Donley's modern saw shop. Send today for FREE BOOKLET on "Sharpening and Repairing Cold Saws".

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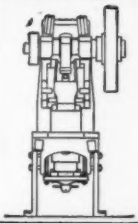
FOR ANY PUNCH PRESS FROM ½-TON TO 500 TONS



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DAYTON ROGERS *Manufacturing Company*

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for FAST • SAFE • BETTER Material Handling of

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400 MODELS

Prompt Delivery
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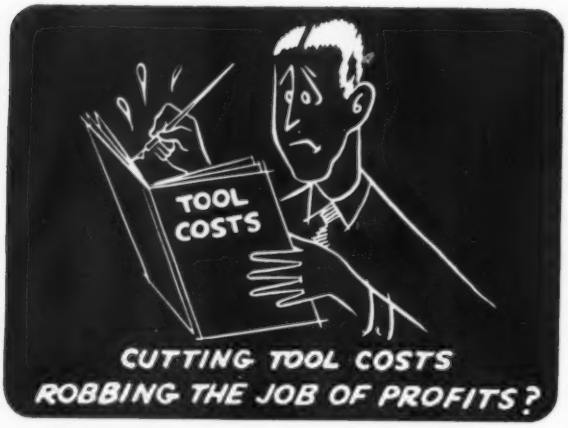

Systematic "NTS" salvage is the best way to cut cutting tool costs

Stop before you discard a worn or damaged cutter. It may be worth many times its scrap value!

Since 1912 we have been restoring all kinds of cutting tools to new usefulness to help shops control their cutter costs.

Can we assist you in studying your operations and tool usage to determine if a salvage program will save money in your plant? There is no obligation.

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NATIONAL TOOL SALVAGE CO.
6511 EPWORTH BOULEVARD DETROIT 10 MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1961

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AIRLOX

TM REG. U.S. PAT. OFF.

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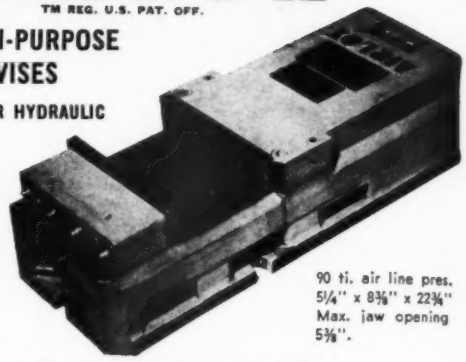

Type S-7 Illustrated

90 ti. air line pres. 5¼" x 8⅜" x 22¾" Max. jaw opening 5⅜".

ADAPTABLE AS POWER JIG OR FIXTURE OR SHORT STROKE BENCH PRESS

AIRLOX vises are precision built tools powered by specially engineered air or hydraulic cylinders. They can be operated manually or synchronized with the movement of a milling machine table or drill press spindle. They can be furnished in sets if desired so that the same tolerance is held between the base cross keyway and fixed jaw casting face on each vise.

AIRLOX patented wedge-&-lever action utilizes total cylinder drive, providing positive rigid grip on the work, exceptionally suited to carbide milling and almost all other milling operations.

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production devices incorporated
Whitehall, N. Y. - - phone 40

CIRCLE INFORM-A-GRAM KEY NO. 1962

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CIRCLE INFORM-A-GRAM KEY NO. 1963

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Full scale reading of 5" — 6" — 8" — 10" Available. Also Foot with Scriber to convert to Vernier Height Gage.

Ask for catalog and prices of other Standard Calipers.

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New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1964

16 Attachments which bring many of the advantages of late model metal sheet feeders to older units now in the field are featured in a 7-page bulletin. Included are descriptions of each device, information concerning advantages offered, and keyed illustrations. Some of the devices covered are the elevator over-travel stop, brake for preventing elevator drift, improved sheet forwarder cam, and frame reinforcing kit. Copies of the bulletin may be obtained from the Dexter Folder Co., Pearl River, N. Y., or —
Circle Inform-A-Gram No. B48.

"Accessories for Lathes & Milling Machines" contains descriptions of plain and expansion type mandrel arbors, die heads, and chucks. There is also a milling machine section which covers boring heads, plates, vises, and indexing tables. It also covers tapping attachments for drilling machines. Illustrations and specifications accompany each section. Catalog GN-2 has been announced by Montgomery & Co., Inc., 7 Tichenor Lane, Newark 2, N. J., or —
Circle Inform-A-Gram No. B49.

A 6-Page Technical Brochure outlines inclined plane cam mechanisms for dressing grinding wheels with intricate contours. It shows how one or more dressing diamonds can be made to follow steep climb angles by altering feed ratios and contour ratios. Typical contours are illustrated and described. Copies of "Hoglund Contour Wheel Dressers" are available from Hoglund Engineering & Mfg. Co., Inc., 343 Snyder Ave., Berkeley Hts., N. J., or —
Circle Inform-A-Gram No. B50.

Governaire Pressure Regulators are explained in a comprehensive catalog released by Strattos Industrial Products Branch, Route 109, Babylon, N. Y. These regulators reduce air consumption to a minimum and save money in maintenance. Other features in addition to detailed specifications and diagram drawings are included in the literature. Information on volume boosters is also given. Direct requests for the catalog to the company, or —
Circle Inform-A-Gram No. B51.

34 Additions to a line of Minute Man standard stock broaches are listed in a 16-page catalog. 3 new stock sizes of production type keyway broaches plus a complete line of standard stock round broaches are included. Keyway broach kits, special broaches, arbor presses, and Minute Man magnetic bases for dial indicators are also described. For your copy of the catalog, write to The du Mont Corp., Greenfield, Mass., or
Circle Inform-A-Gram No. B52.

Standard and Custom Made Shear Blades are highlighted in a bulletin from Simonds Worden White Co., Dayton 7, O. More tonnage sheared between grinds, longer tooling costs, and greater number of sharpenings per blade are some of the advantages outlined in the bulletin. Also included are some suggestions for correct clearance which produces low cutting pressures, longer life between grinds, and clean sheared edges. Write to the company for a copy of the bulletin, or —
Circle Inform-A-Gram No. B53.

A Series of 11" and 13" variable speed precision lathes is described and illustrated in a bulletin. Complete specifications and detailed information on the variable drive and other modern design features of these lathes are outlined. These new lathes provide automatic power selection of spindle speeds from 40 to 2000 rpm., and speeds are read on a built-in tachometer in the headstock. Bulletin 5-31-57 is published by Sheldon Machine Co., Inc., 4258 N. Knox Ave., Chicago 41, or —
Circle Inform-A-Gram No. B54.

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MICROMETER ADJUSTABLE REAMERS

Typical Applications:
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- CHUCKING MACHINES
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Type S for through hole reaming.
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Range in Sizes: ¾" to 8" in only 18 units

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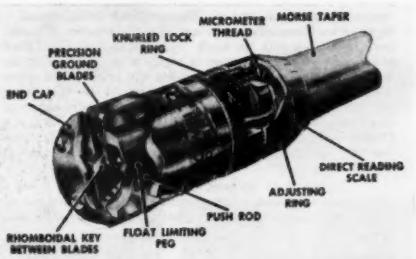
The initial cost of a Wickman-Brown reamer is your last major expenditure. The blades, available in both high speed steel and tungsten carbide, are precision ground and may be sharpened repeatedly without affecting micrometer reading.

Eliminates costly floating tool holders by built-in positive and predetermined float.

Down time is eliminated on production due to micrometer adjustability without removal of blades or unit from machine.

Distributors' Inquiries Invited



THE Wickman MANUFACTURING CO.
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CIRCLE INFORM-A-GRAM KEY NO. 197

Complete Equipment for the Metal Processing Industry is listed in an indexed, illustrated catalog. Specifications of over 8,000 stock gears, sprockets, worms, splines, and ratchets are featured with special emphasis on gears and sprockets from ⅛" to 164". Also described are uncoilers, slitters, and automatic feeds and reels for punch presses. Copies of the catalog are supplied by Universal Gear and Machine Co., 1301 E. McNichols, Detroit 3, or —
Circle Inform-A-Gram No. B55.

Various Types of Rollers and Frames for engineered gravity and live roller conveying systems are described in a bulletin. It contains blueprints and complete specifications on rollers to meet any operating condition. Included are rollers with continuous load ratings from 30 to 8,000 lbs with plain ball bearings, as well as grease seal or dust tight type. Direct requests for copies of the brochure to Alvey-Ferguson Co., 1891 Disney St., Cincinnati 9, or —
Circle Inform-A-Gram No. B56.

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that thinks for itself?
POSITIVE FEED
(MINIMUM PENETRATION)
FRICTION FEED
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MARVEL SAWS' Automatic "Brain" Adjusts Blade Feed Pressure and Depth on Every Stroke to
GIVE YOU FASTER CUTTING-OFF
The exclusive automatic Dual Power Feed built into every MARVEL Series 6 and 9 Hack Saw is the "brain" that adjusts and compensates both pressure and depth of feed correctly in proportion to the number of blade teeth in contact with the work. Once the MARVEL Dual Feed is set, no operator attention is required to insure that the blade is cutting as deeply as possible and practical on every stroke . . . regardless of the changing area of the work being cut. Whether the Saw is being used for continuous automatic cut-off of identical pieces or a single cut, the MARVEL Dual Feed that practically "thinks for itself" guarantees that the work is cut-off in the fewest possible number of strokes.
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Better Machines-Better Blades
CIRCLE INFORM-A-GRAM KEY NO. 198

A 12-Page Bulletin features 8 models of headstock and tailstock welding positioners in capacities ranging from 5,000 to 160,000 lbs. Complete data on each model is given plus a page of comprehensive specifications and quality features which include precision rotation, positive ground current conduction, and a range of optional extras. Copies of Bulletin HTS57 are supplied by Aronson Machine Co., Arcade, N. Y., or—**Circle Inform-A-Gram No. B57.**

A 72-Page Illustrated Catalog describing the line of CF&I-Wickwire has been announced by The Colorado Fuel and Iron Corp., 575 Madison Ave., New York. Diagrams and descriptions of various types and grades of wire, include low carbon coarse wire, high carbon fine and specialty wire, low carbon fine and specialty wire, and flat and shaped wire which are available. For your copy of the wire catalog write to the company, or—**Circle Inform-A-Gram No. B58.**

An 8-Page Condensed Guide to stainless steel fasteners presents 37 different types of standard fasteners with illustrations. Screws, nuts, bolts, washers, rivets, and government specifications AN fasteners are included. Data pertaining to sizes carried in stock, threads, head and point styles, and grades of stainless steel are discussed. Direct requests for copies to Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y., or —
Circle Inform-A-Gram No. B59.

Automatic Centralized Systems for original equipment or existing facilities are discussed in the bulletin, "Power Lubrication." Three types of Multi-Luber power lubrication systems to meet all requirements are outlined and diagrams accompany the material. Typical installations of these systems are also shown. A section of air operated lubricant pumps with air return and spring return is included with pictures. Bulletin 811 is being distributed by Lincoln Engineering Co., 5701 Natural Bridge Blvd., St. Louis 20, or —
Circle Inform-A-Gram No. B60.

A 24-Page Brochure describes a variety of prism and grating spectrographs, and related accessories produced by Hilger & Watts Ltd. Featured in the illustrated brochure is data on the design, application, and characteristics of each type of instrument; plus specification tables and graphs which permit quick comparison of individual performance ranges. Copies of Brochure CH403 are being distributed by the Information Service of the Jarrell-Ash Co., 26 Farwell St., Newtonville 60, Mass., or —
Circle Inform-A-Gram No. B61.

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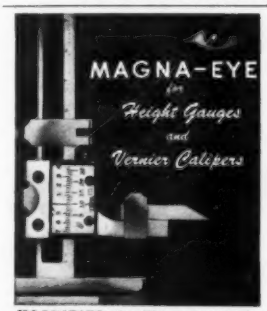

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MAGNIFIES the "hard to read" vernier scales on calipers and height gages. No more eye strain, guess work or hit or miss setting and reading. **LENS** is finest quality optical glass, specially designed and ground for the purpose with utmost optical skill. 4X magnification shows lines true and correct. In daily use in plants of Westinghouse, General Electric, General Motors, Chrysler, Packard, Ford, Boeing Aircraft, Bendix Aviation and many others engaged in defense work.
Made in 3 sizes to fit Starrett, Brown & Sharpe, Lufkin Tools, and others of similar design. **S No. 100** for 6" Vernier Calipers; **S No. 200** for 10"-12" Height Gages, also 10"-18"-24" Vernier Calipers; **S No. 300** for most popular type 18" and 24" Height Gages and for 36"-48" 60" and 72" Calipers.
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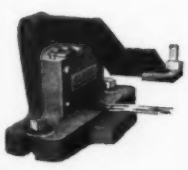

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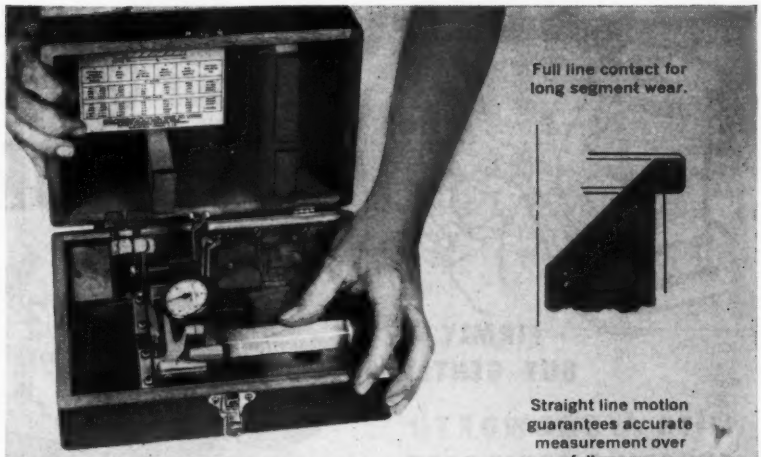

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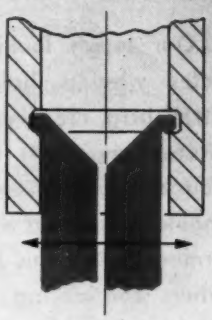

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Special segments available for checking non-standard grooves, concentricity of groove to bore, or depth of groove to face.
Groove segments can also be used on the Bryant B-21 Bench Gage.

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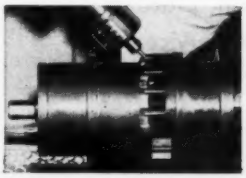
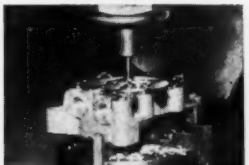
of their durability and long life lies in our method of grinding which produces a smooth, unbroken cutting edge. No saw-tooth edge to load-up and break-down.

See the display of Micro-Miniatures at your jobbers or write us for details.





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CIRCLE INFORM-A-GRAM KEY NO. 1995

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CIRCLE INFORM-A-GRAM KEY NO. 2001

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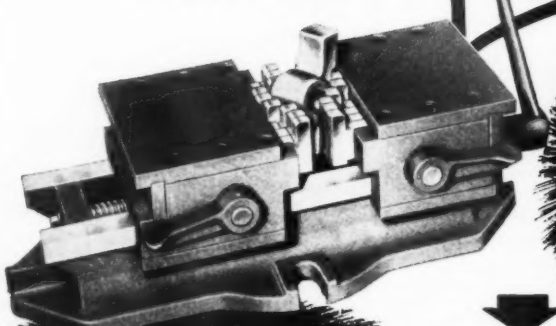
Contour Gripping FIXTURE

SAVES YOU MONEY!



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INSTANTLY GRIPS AND HOLDS ANY ODD SHAPED PIECE

TAKE BIGGER CUTS
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THOUSANDS OF USES

This amazing fixture holds any shape in any position . . . for drilling, milling, shaping or grinding. It only has to be set once to take identical pieces for any operation on all types of machine tools.

Investigate its possible application in your business. Write for further details or demonstration.

NO MORE BLOCKING SHIMMING HOLDS ANY SHAPE IN ANY POSITION

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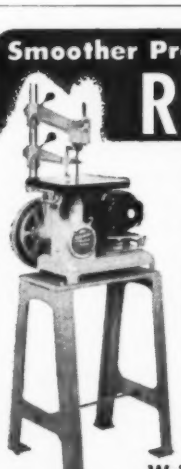


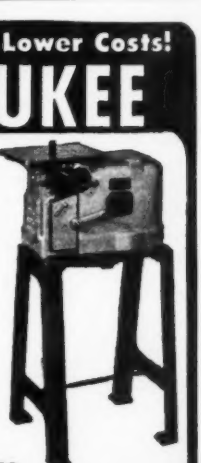
DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.



Write for Illustrated Bulletins and Prices

RICE PUMP & MACHINE COMPANY
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CIRCLE INFORM-A-GRAM KEY NO. 2003

Saws for Metal Working are illustrated and described in Catalog MS-500. Saws are segmental in both coarse and fine pitch styles, high speed, Semhi, carbide tipped, band saws, and slitters. The catalog also includes tool bits and steel specialties. Special metal parts can be made to specifications and furnished to close tolerances. The lapping facilities finish grind metal parts to any micro finish required. For copies write to Huther Bros. Saw Mfg. Co., Inc., 1290 University Ave., Rochester 7, N. Y., or —
Circle Inform-A-Gram No. B62.

Protection Against Rust, Abrasion, and Contamination are some of the advantages of Seal-Peel described in a bulletin. This is a hot-melt protective strippable coating that goes on quickly and often eliminates the need for additional wrapping. There are several Seal-Peel formulas designed to solve every protection problem. For additional information, write to Seal-Peel, Inc., 775 Stephenson Hwy., Royal Oak 3, Mich., for the bulletin, or —
Circle Inform-A-Gram No. B63.

Benelex, a strong, durable die stock for use in fabrication of sheet metal and thermoplastic sheets, is presented in a catalog. Available in thicknesses from ⅛" through 2" and sizes up to 48" x 144", the product's other features and specifications are included in the literature. Suggestions for uses and applications are also discussed. Copies of the Masonite Benelex Data Book may be obtained from the Masonite Corp., 111 W. Washington St., Chicago 2, or —
Circle Inform-A-Gram No. B64.

A Grind-All Fixture brochure explains and illustrates this product designed for attaining higher accuracy, greater range, and maximum speed in grinding perforators. The brochure outlines the hand crank for easy rotation of the index plate and the single locking screw for quick V-block adjustments. Photos showing the various irregular shapes which can be ground by the Grind-All fixture and applications are included. The brochure is compiled by the Harig Mfg. Corp., 5757 W. Howard St., Chicago 31, or —
Circle Inform-A-Gram No. B65.

18-Ton Capacity is a feature of the angle iron shear described in a bulletin. This 26" high machine can shear angle iron up to 4" x 4" x ¼" and bend flat mild steel 6" x ⅜". Other specifications and advantages of this shear are outlined in the bulletin. It can be used by sheet metal shops and manufacturers of many types of products. Obtain the bulletin from W. A. Whitney Mfg. Co., 636 Race St., Rockford, Ill., or —
Circle Inform-A-Gram No. B66.

Ceramagnet, the high coercive force permanent magnets that are molded from low cost ceramic powders, is the subject of a revised bulletin. This bulletin includes diagrams and illustrations of specific Ceramagnet uses and their advantages for various mechanical, electrical, and electronic applications. Also included are ten graphs plotting important magnetic characteristics. Request copies of Bulletin RC-11A from Stackpole Carbon Co., St. Marys, Pa., or —
Circle Inform-A-Gram No. B67.

An 8-Page Catalog describes the Clamp-N-Jack Setup system for use with boring mills, planers, milling machines, presses, and drill presses. This is a faster method of making setups on medium and short run production. The catalog shows typical applications on various types of machine tools, gives actual experience data, and explains the function of all components. Catalog 557 is made available by The Universal Vise and Tool Co., Parma, Mich., or —
Circle Inform-A-Gram No. B68.

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R-O Grinder

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IT MAY CUT YOUR PERISHABLE TOOL COSTS IN HALF!

HERE ARE 5 INTERESTING FACTS ABOUT R-O RELIEF

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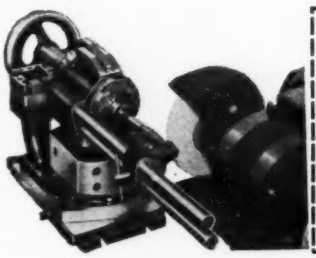
5. In most cases is actually faster than grinding regular angular back-off.



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CIRCLE INFORM-A-GRAM KEY NO. 201

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COUNTER BALANCED

CAST IRON HAND WHEELS

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Quality at Moderate Prices!

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CIRCLE INFORM-A-GRAM KEY NO. 2022

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Manufacturers of Rousselle Presses

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

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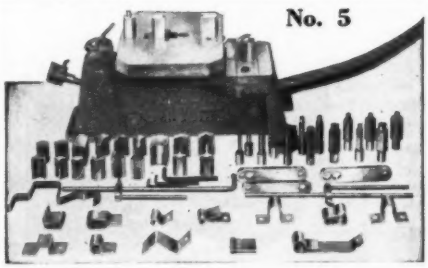

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CUTS, BENDS, PUNCHES

Available in hand or air operated models, the MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛"x1½" as illustrated. Punching and round end blanking dies available. Other models up to ¼"x4" air operated.

ALSO AIR OPERATED MODELS

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Number **1** in Supplying
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Making better products...
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— over 180 scientists and technicians in specialized laboratories using the very latest scientific apparatus developing new and improved abrasives and bonds to cut your grinding costs.

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**Warehouse Facilities and Stocks at this location*

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BEHR-MANNING CO., Troy, N.Y. is a division of Norton Company

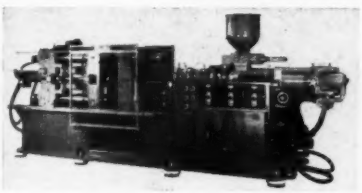
5-57

What's New In Plastics

"Molded Plastics," an 8-page catalog, outlines the features and advantages of the plastics. A chart lists the properties of these plastics, and a few suggestions for plastics design are discussed, accompanied by simplified drawings. Write to The Richardson Co., 2778 Lake St., Melrose Park, Ill., for a copy of Catalog 01.0002, or —
Circle Inform-A-Gram No. E1.

A Properties Chart of Epibond adhesives and epocast pastes is being offered by Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39. A description of each type is given along with specifications and typical applications. Included in the chart is a table of the bond resistance for each product. Write to the company for copies, or —
Circle Inform-A-Gram No. E2.

The Fellows 12-350 Injection Molding Machine was designed to mold a wide variety of plastic products in the intermediate size range of 12 to 20 oz, the 20-oz shots requiring the use of the optional Pre-Pac or stuffing device. The machine dry cycles



at 700 per hr and handles mold bases up to 20" by 31½" with a 14" draw. It is equally capable of producing either the deep-draw, thin-wall parts or heavier sections. The Fellows Gear Shaper Co., Springfield, Vt., will supply more information on this machine, or —
Circle Inform-A-Gram No. E3.

Remove Epoxy, paint, polyester, etc, with Epoxy remover, a hand cleaning compound described in a bulletin. It is used in pattern shops, tool and die firms, and other industries where resistant materials come in contact with the skin. For more information, write to U. S. Gypsum Co., 300 W. Adams St., Chicago 6, or
Circle Inform-A-Gram No. E4.

Information About Hysol Resins is presented in Technical Bulletin T-21. Of interest to design, tooling, and production engineers, it deals with laminating resins used in combination with glass cloth for the production of dimensionally stable laminates at contact pressure. The bulletin also describes uses, materials, and physical properties of resins and laminates. Copies of this bulletin are published by Houghton Laboratories, Olean, N. Y., or —
Circle Inform-A-Gram No. E5.

Materials for Fiber Glass Reinforced Plastics are featured in a 14-page catalog. Included are complete ranges of fiber glass fabrics and fibers, polyester and epoxy resins and catalysts, and other supplies. Available sizes and grades are shown under each material, along with thumbnail descriptions of properties and recommended applications. The plastics catalog is made available from Cadillac Plastic & Chemical Co., 15111 2nd Ave., Detroit 3, or —
Circle Inform-A-Gram No. E6.

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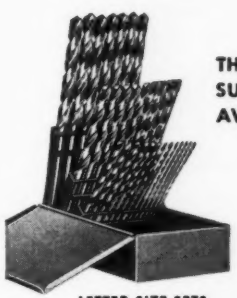

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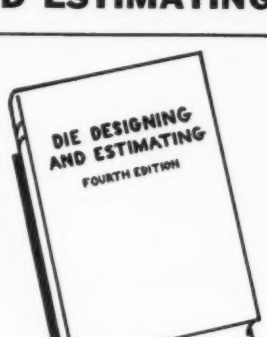

Written expressly for Die Designers, Die Engineers, Tool and Die Makers, Owners and Managers of Tool and Die Shops and Depts., Students, Apprentices and valuable, too, as a reference and refresher for the die experts who are more than qualified to write a comparable text.

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CONTOUR PROJECTER USED FOR PRODUCTION LINE OR TOOLROOM

An interchangeable table system that includes a flat staging table for production line optical gaging and a movable work table for horizontal toolroom measurements is now available.

The two tables for this Kodak Contour Projector, Model 14-6, may be purchased separately and can be quickly mounted on the projector as manufacturing conditions dictate.

Other Kodak contour projectors have included either a flat staging table or movable work table as individual component features. However, with the new interchangeable table system, both features are combined for one projector.

With the flat 13" x 19⅝" staging table in place, the projector meets the exacting requirements of "on-the-line" inspection work. A convenient 8" working distance at all magnifications, optimum screen and "surface" illumination, good definition and correction for distortion, and simple co-ordination between chart and fixture are provided. The projector is capable of providing accurate, speedy and economical handling of an almost unlimited variety of parts.

It is a simple operation to convert for limited toolroom measurement work: The movable worktable replaces the flat staging table, and rapid horizontal measurement to 0.0002" is made possible. The slotted 19¼" by 8" worktable permits use of standard fixtures for simplified staging of a wide variety of toolroom parts.

The Ohio Knife Co., Cincinnati, has recently installed one of the largest and longest heat-treating furnaces in operation. Now, wear plates, liners, shear blades, knives, and other products up to 240" long can be hardened all at once, giving absolute uniformity of hardness and temper throughout the entire length of the section.

Drill or Tap OVER A MILLION different hole combinations on any drill press!

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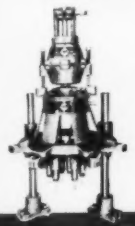
Universal Ball Joint Adjustable Spindle MULTIPLE DRILLING AND TAPPING HEADS



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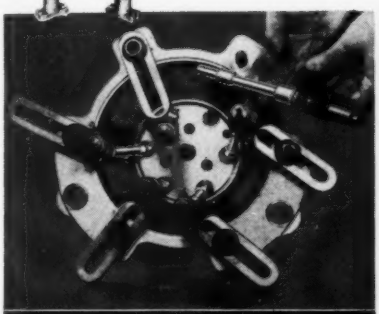

Underview of model 600 head. Design of spindle and locating arm assures rapid accurate setting of spindles—even while unit is running.

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No reversing motor needed
Light weight and compact
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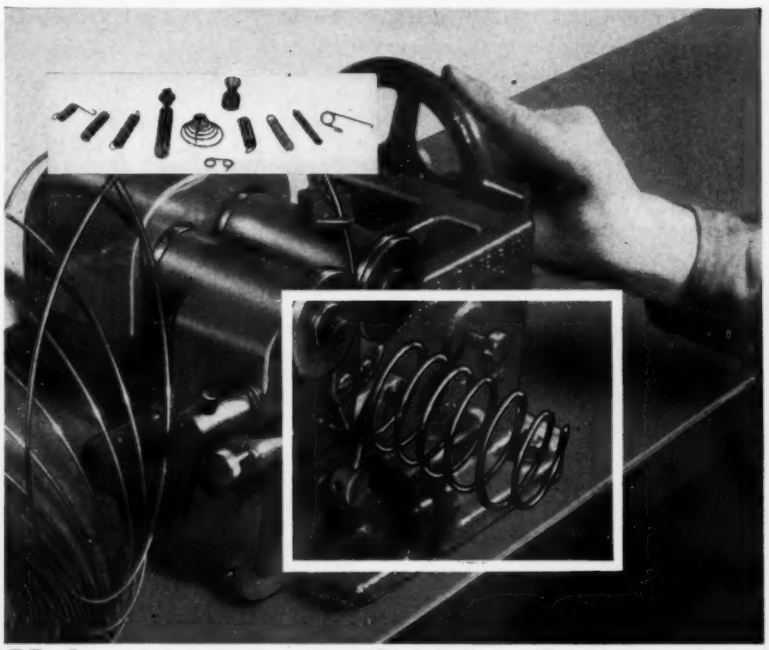

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For a replacement or experimental spring, any shape, diameter or pitch from flat or round wire sizes .005" to .125", you can produce it in a matter of seconds with Perkins Precision Spring Coiler. You eliminate arbors, yet turn out precision springs — torsion, compression, extension, tapered, or special springs, coiled either left or right hand, in any desired length, any diameter from 3/32" to 12" and larger, with or without initial tension, and with open or closed ends. Eliminate expensive special orders and costly production delays! Make your own springs to exact specifications as replacements or experimental work. Make them fast, right in your own shop!

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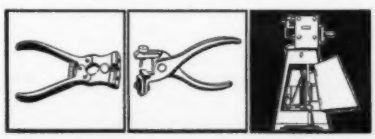

Starret adjustable jaw cut nippers (left) and Gardener Hook-Kon spring looping tool (center) — handy, precision, time-saving accessories for spring coiling. Perkins Spring Coiler available as bench model or power model shown here, (right) for tool shop or continuous runs.

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Please send information and prices on Perkins Spring Coiler.
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CIRCLE INFORM-A-GRAM KEY NO. 2073

Collins Microflat Co., has appointed **Al LaCom** general sales manager.

•

Bernard C. Dunn, sales supervisor for milling machines at the Axelson Mfg. Co., now also serves as sales engineer for lathes in the Los Angeles, Santa Barbara, and Bakersfield area.

Norton Co. has appointed **Edwin R. Reed** as California district sales and service engineer for the Grinding Machine Division. **John C. Ewer** has been appointed assistant sales manager, Abrasives.

•

The appointment of **W. A. Johnson** as sales manager of the Grinder Division has been announced by Royal Oak Tool & Machine Co.

•

T. G. Gascoigne joins the West Coast staff of Avildsen Tools and Machines Inc., as chief service engineer.

How do you judge power chuck values?

By *Accuracy?*

.001" is *guaranteed* with this chuck — on new runs and re-runs, *without re-truing jaws.*

By *Pieces Per Day?*

You can make drastic cuts in down-time with the Buck. Top jaws can be machined in the tool room — hardened — and fitted *in minutes.* Final accuracy adjustment is made under actual operating conditions *with full air pressure.*

By *Chuck Life?*

Hardened key ways greatly prolong production service. The Ajust-Tru principle helps compensate for wear.

By *Price?*

You get all these extra Buck features *at conventional power chuck prices.*

Buck AJUST-TRU® **POWER CHUCK**

Hardened Key Ways Standard Feature

A Buck *plus* at no extra cost. Combined with hardened top jaws (made practical by the Buck for all operations) you can run thousands more pieces than with conventional chucks. Chuck sizes are: 6½", 8¼", 10", 12" — made with 2 or 3 jaws.

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CIRCLE INFORM-A-GRAM KEY NO. 208

Brown & Sharpe Mfg. Co. announces changes in its field sales organization. District sales managers include: New England, **Herbert Richardson** for machine tools and **Russell O. Newton** for industrial products; Cleveland, **W. H. Stewart,** machine tools, and **F. L. Pritchard,** industrial products; and on the West Coast, **Vernon L. Wade,** industrial products, and **John A. Rinek,** machine tools.

•

The New York district sales manager for the Magnethermic Corp. is **Roy L. Hoeck.** His headquarters will be in Westfield, N. J.

•

Frank W. Ingold has been named to the newly created post of sales manager for the Cincinnati steel service plant of Joseph T. Ryerson & Son, Inc. Succeeding Ingold as sales representative in the Ohio area is **Elmer A. Jahnke, Jr.**

•

The new West Coast sales engineer for Engelberg Huller Co. is **Lawrence Abbott.** Abbott's territory will include Washington, Oregon, California, Nevada, Idaho, and Arizona.

•

Firth Sterling Inc. announces the promotion of **J. Martin Stokes** as assistant to the vice president of sales. He was formerly manager of the Carbide Sales Division. **William J. Ulm,** formerly assistant to the vice president of sales, is now manager of customer service. Carl C. Krogh has been promoted to manager of the Carbide Division.

•

The appointment of **Louis A. Michaelsen** as sales manager has been announced by Beaver Tool and Engineering Corp. Previously he was chief factory sales representative.

•

Edward G. Merk has been appointed sales manager for Diamond Machine Tool Corp.

•

The Abrasives Division of Elgin National Watch Co. announces the appointment of **William E. Burgoyne, Jr.** as sales engineer in the New York City area. His office will be located in Montclair, N. J.

•

Portage Double Quick, Inc. announces the appointment of **David W. Puckett** as West Coast Division manager. He will be in charge of Portage's new West Coast offices and warehouses in Compton, Calif.

•

Robert F. Reid has assumed the position of sales manager for Arter Grinding Machine Co.

Now Available...
FOR YOUR CONVENIENCE

Miccro *Supreme Spray*

LAY-OUT DYE
(Purple)

A *new*, easy-to-use, dependable, spray Lay-Out Dye for tool, die, pattern, or template layout on metal. Dries instantly—shows up in sharp relief.

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Also Still Available...

Miccro *Supreme*

LAY-OUT AND IDENTIFICATION DYE (7 Colors)

For layout on metal and quick identification of bar stock, sheets, strips, or parts. Also dries instantly and shows up in sharp relief. Available in brush-in-cap cans and larger containers.

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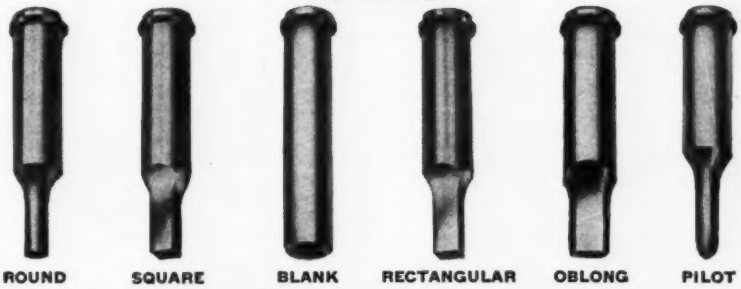
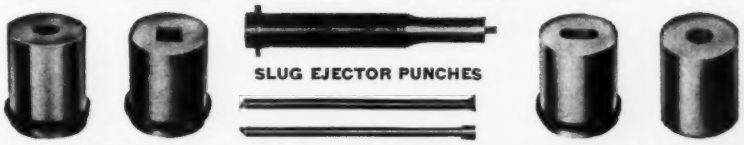
STANDARDS



ROUND SQUARE BLANK RECTANGULAR OBLONG PILOT



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HIGH SPEED BEVEL & SHOULDER HEAD QUILLS

COMPLETELY INTERCHANGEABLE
SHIPMENTS FROM STOCK
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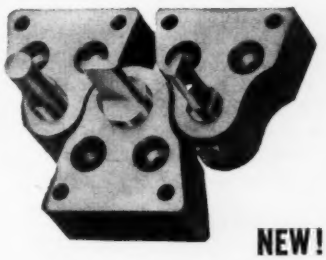
LOW COST

SPECIALS
Send prints or sketches for quotation on your requirements. Prompt deliveries—reasonable prices.



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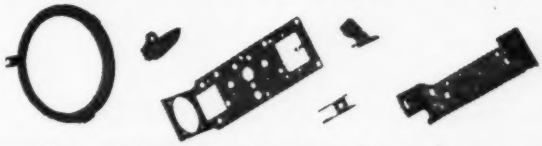

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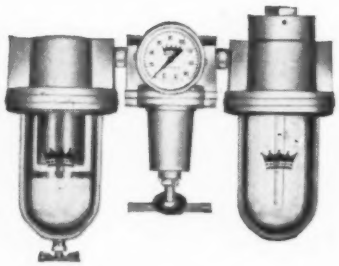

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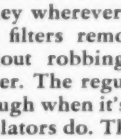
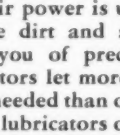


"COMBO" UNITS
Bulletin 300



REGULATORS
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Position.....

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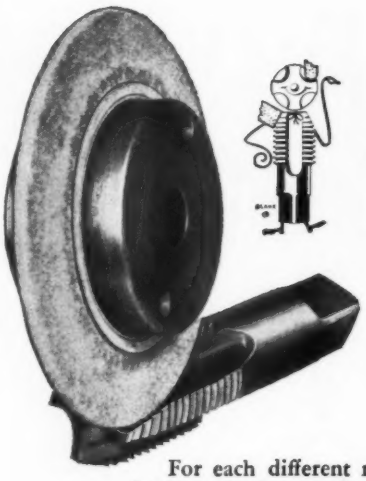


For Profitable Tapping, Grind Your OWN Best Rake Angles!

Controlled grinding of tap flutes and chamfers.

For each different material, there is a "best" rake or hook angle for tapping. You can grind and re-grind this angle on taps for each of your jobs . . . positively and accurately, time after time . . . with the BLAKE Flute Grinder.*

Combined with the BLAKE Chamfer Grinder, this machine can give you substantial savings even with Class 3 or 4 fit standards, because you will have:

1. Best rake or hook angle for the material tapped.
2. Exact indexing of cutting edges.
3. Correct spiral points.
4. Accurately relieved chamfers.

The increased uniformity and accuracy of your threads, plus *far* greater tap life, are the sound basis for maximum savings in your tapping costs.

Ask us for the details of what this combination can do for you.

**Now available with air operated vertical slide.*

EDWARD **BLAKE** COMPANY INC.

MANUFACTURERS OF FLUTE AND CHAMFER GRINDERS

442 CHERRY ST., WEST NEWTON 65, MASS.

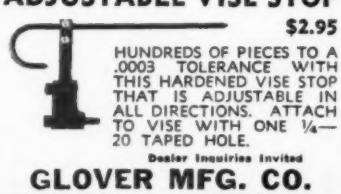
Exclusive Distributors of:
BLACK DIAMOND PRECISION DRILL GRINDERS • SURFACE FINISH STANDARDS • WORCESTER DRILL GRINDERS

CIRCLE INFORM-A-GRAM KEY NO. 2102

.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

$2.50 NEW — POSTPAID except C.O.D. — $10.00 DELUXE



- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.

◄ NEW .500 DIA. MODEL FOR LARGER WORK ONLY. .200 Dia. ►

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

Dealer Inquiries Invited

GLOVER MFG. CO.

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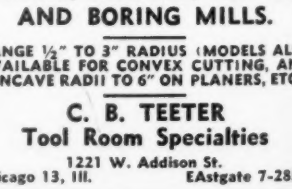
Monarch Precision

SHAPLANE Radius Tools

Patent Pending



Five Models for

LATHES, SHAPERS, PLANERS AND BORING MILLS.

RANGE ⅛" TO 3" RADIUS (MODELS ALSO AVAILABLE FOR CONVEX CUTTING, AND CONCAVE RADII TO 6" ON PLANERS, ETC.)

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Tool Room Specialties

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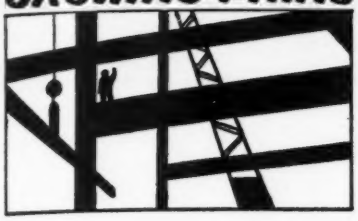
GROWING PAINS



Vidmar Inc., a new division of **Volkert Stampings, Inc.,** will occupy a new 44,000-sq-ft plant in Williamsport, Pa., next year. The division will produce tool storage cabinets, blueprint cabinets, and other industrial storage equipment there.

◆

Raytheon Manufacturing Company is adding 20,000 sq ft to its Maynard, Mass., laboratory. The new area will help house the Magnetics and Electronic Reliability groups and a machine shop. It will also increase facilities for assembly of electronic devices.

◆

The Carborundum Company has launched a $3,200,000 modernization and expansion program at its three silicon carbide furnace plants. Most of the expansion will take place in the Shawinigan Falls and Vancouver plants.

◆

The Dynamatic Division of Eaton Manufacturing Company has started construction of a new office building in Kenosha, Wis., as the final phase of its expansion program.

◆

Construction of a new plant in Jonesboro, Ark., has been announced by **The Colson Corporation,** manufacturers of wheeled products for institutions and industrial material handling equipment. The 89,000-sq-ft building will be used for most of the company's caster production.

◆

The Herman Stone Company is opening a new manufacturing plant in Mount Airy, N. C. The two-story plant cost over $100,000 and is located near other production facilities opened several years ago by the company.

◆

Providing facilities for a considerable increase in toaster production of the **Proctor Electric Company** is the nearly completed $1-million plant. The 94,000-sq-ft plant is located in Mount Airy, N. C.

A new plant of 22,000 sq ft has been planned by **Admiral Tool & Manufacturing Company.** They expect to break ground this month and the new building should be completed by February.

◆

A $33-million expansion program has been planned by **Lukens Steel Company.** Plans include a breakdown mill, additional ingot soaking pits, and changes in the present mill.

An expansion program that doubles the size of its manufacturing facilities has been announced by the **Computer Division of Bendix Aviation Corporation.** The need for additional engineering, production, and marketing facilities will be met by the construction. Bendix is also constructing a $2-million manufacturing support building. It will provide 82,000 sq ft of manufacturing space for receiving inspection, quality control testing functions, and other manufacturing support activities.

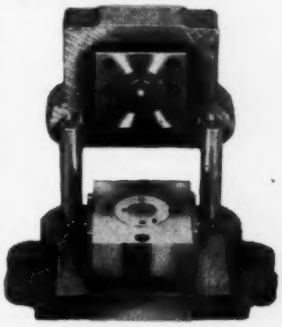
ARE YOU USING- HOVIS UNIVERSAL Master COMPOUND DIES

to Produce WASHERS and SMALL STAMPINGS from all Types of Materials the ECONOMICAL WAY?

SAVES DESIGNING COST TIME • LABOR MATERIALS STORAGE SPACE

The "MODERN METHOD" adopted by MANUFACTURERS NATIONALLY

NO NEED TO MAKE A NEW DIE FOR EVERY STAMPED PART



● By simply removing and replacing five, small, interchangeable inserts a new part may be produced . . . This method makes possible all production including irregularly shaped pieces and shallow draws.

Made in 5 sizes: ¾" - 1½" - 2½" - 4" - 6"

Specialists in designing and manufacturing MULTI-DIES as well as supplying COMPLETE TOOLING FOR ALL SIZES OF NUT FORMERS

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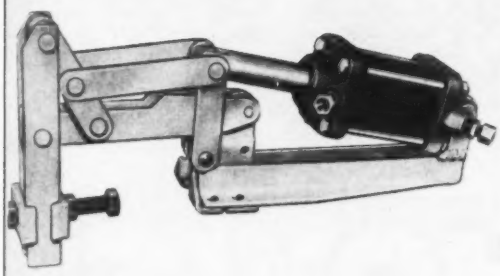
PRODUCTS

NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS



AIR CLAMP . . .

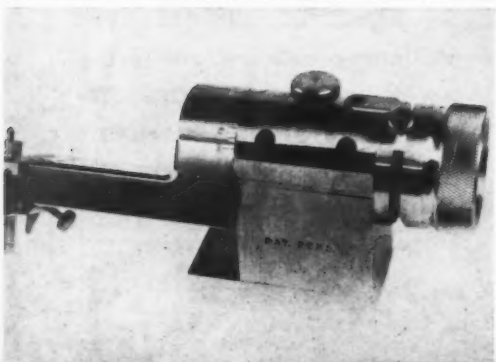
Air operated clamps, capable of exerting 800 lbs holding pressure have been added to the air clamp line offered by Lapeer Mfg. Co., 1150 W. Baltimore, Detroit 2. Two standard models, the AO-800 toggle clamp for conventional clamping and the AODT-800 double-toggle type for difficult mounting situations are available.
Circle No. A1.

AIR DRILL . . .

Drill aluminum alloys, titanium, or heat-treated stainless and alloy steels with a K-Matic positive feed air drill. Available with 4″ stroke, it develops up to 1000 lbs of thrust. The positive feed feature avoids work hardening. Gardner-Denver, Quincy, Ill., or —
Circle No. A2.

MILLING CUTTERS . . .

Machine aluminum and ferrous materials with dual-purpose milling cutters. Because the high-helix angle prevents hogging in, the tools are ideal for light cuts on thin springy pieces or intermittent cuts on frail parts. Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, or —
Circle No. A3.

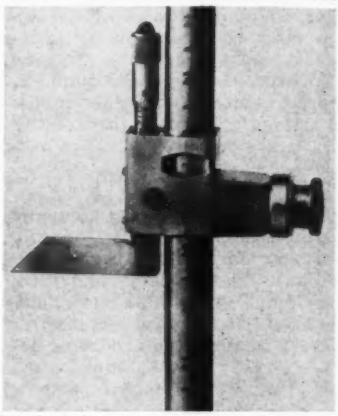


DRESSING TOOL . . .

Eliminate guesswork when grinding forms with the Clearview Radi-Angle form dresser. By sighting the diamond point through the lens, radii and angles can be made tangent. Accuracy of the tool is 0.0001″. Glover Mfg. Co., 422 Park Ave., Meadville, Pa., or—
Circle No. A4.

HEIGHT GAGE . . .

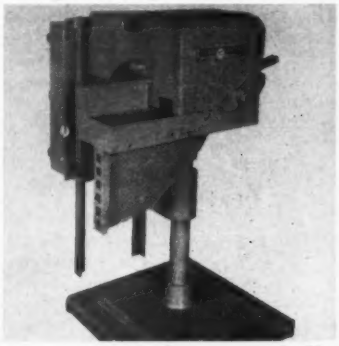
Absolute positive action is controlled by indexing at 0.500″ intervals, by means of hardened steel balls set in a stainless steel column with the Microball. With



this height gage intermediate settings are made by operating the micrometer gage incorporated in the design, reading direct to within a tolerance of 0.0005″. Foster Supplies Co., 6122 Milwaukee Ave., Chicago 30, or —
Circle Inform-A-Gram No. A5.

GEAR CLASSIFIER . . .

Extreme accuracy of size measurement in an automated electronic gear classifier is achieved by utilizing a double-pivoted mounting for the upper non-rotating master gear. This arrangement permits true size



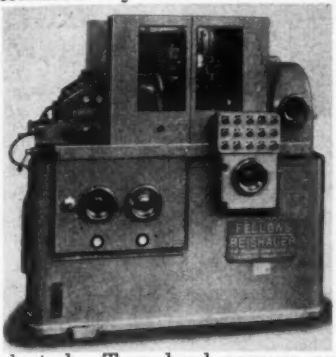
measurement of spur or helical gears to be made regardless of helix angle variations. Model GRF measures 1″ dia helical automotive automatic transmission pinions. National Broach & Machine Co., 5600 St. Jean, Detroit 13, or —
Circle Inform-A-Gram No. A6.

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

GEAR GRINDER . . .

Capable of grinding spur and helical gears up to 12" OD and 6¾" face width is the No. 12 Fellows-Reishauer gear grinding machine. The pitch range is determined by the lead screw



selected. Two lead screws are available, one covering from 6 to 48, and the other from 20 to 120 diametral pitch. Low cost grinding of single piece and long production runs are possible. The Fellows Gear Shaper Co., Springfield, Vt., or —
Circle Inform-A-Gram No. A7.

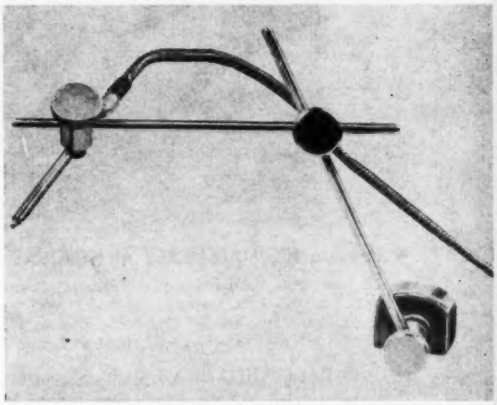
OVERLOAD CONTROL . . .

Accuracy, continual indication of motor load, and adjustable load limits are features of the fail-safe overload control. The Load Sentry is intended for use whenever overload of any kind may be registered on an electric

motor. An interlock keeps the circuit broken after an overload until the condition causing the trouble has been corrected and a manual reset button has been pressed to restart the motor. Assembly Products, Inc., Chesterland, Ohio, or —
Circle Inform-A-Gra mNo. A8.

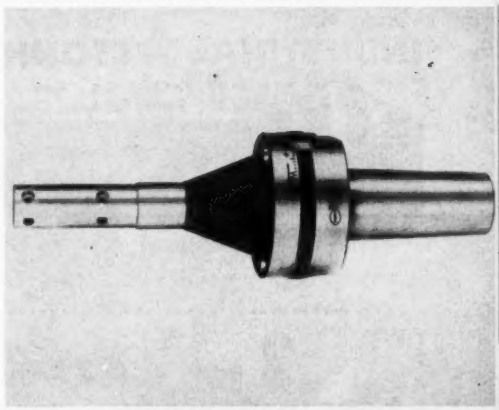
NOZZLE HOLDERS . . .

Simplify the application of mist cooling for any production job with a flexible nozzle holder used with Mistic Mist generators. It is adaptable to multiple nozzle units with additional joints, and with magnets removed it can be permanently mounted. Aetna Mfg. Co., 188 S. York St., Bensenville, Ill., or—**Circle No. A9.**



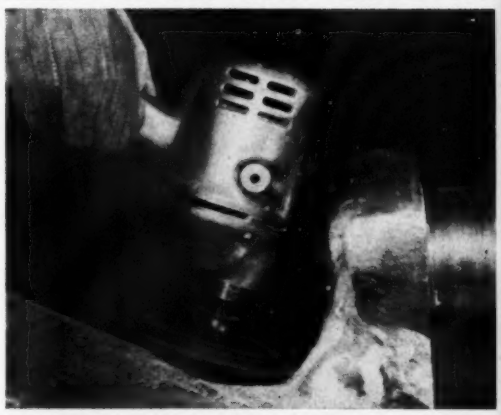
BORING . . .

The Deka-Bore boring head has a roughing tool in the front of the quill that will remove stock from a cast hole, and the finishing tool will follow behind and finish the hole. Tolerance is 0.0003". It can be made as short as 1½" for boring in close quarters. Precision Tool Mfg. Co., Inc., 1305 S. Laramie, Cicero, Ill., or —
Circle No. A10.



MUSHROOM DISCS . . .

For contour grinding or polishing in small radii or difficult contours with portable tools, use a mushroom shaped molded rubber pad and coated abrasive discs. They are available in 5" and 8" dia. Swirl marks and gouges are almost eliminated, cutting finishing operations. Behr-Manning Co., Troy, N. Y., or—**Circle No. A11.**



CIRCULAR TABLES . . .

For checking and layout operations as well as jig borers and other machine tool use is a line of imported precision circular tables. The tables are available in plain rotary and the tilting table in sizes from 10" to 40" dia. Opto-Metric Tools, Inc., 137 Varick St., New York 13, or — **Circle No. A12.**

SETS of Super-Precision MASTER BALLS

● **Provide HIGH ACCURACY at NOMINAL COST**

Chrome steel, hardened and stabilized; accurate to .000010". **Set No. 32** (illustrated): 31 balls, 1/16" to 1" diam. by 1/32" steps. **Set No. 64:** 62 balls, 3/64" to 1" by 1/64" steps. Have 1001 uses in shop, tool room and gage room.

FREE 8-PAGE BULLETIN tells applications; gives methods and formulas for *simplified checking* of internal tapers, ID's, hole depth, etc. *Write for Bulletin 552 — today!*

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PRECISION BALLS OF ANY SIZE OR MATERIAL
ANTI-FRICTION BEARINGS FOR SPECIAL REQUIREMENTS
TOOLING BALLS — MASTER BALLS — SPHERICAL FINISHING

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ELEVATING WORK TABLE
for FAST, SAFE, handling of dies

A strong, husky, die table with big overload safety factor

2000 lb. capacity

NOW $245.00
f.o.b. Chicago

This "one man" die handler belongs in every machine shop

GREATER LIFTING RANGE

Sturdy, reinforced 24" x 36" table top elevates from 24" min. to 42" max. above floor.

Roller bearings in wheels and casters for easy moving. Floor lock included.

High and low speed crank studs at each end of table.

Order Today — Free Trial

Specify 10 day free trial with full credit return privilege.

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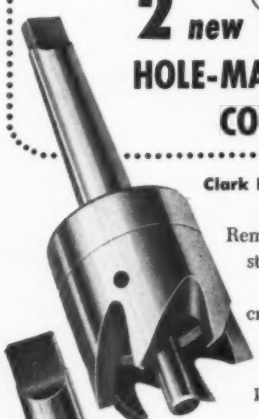
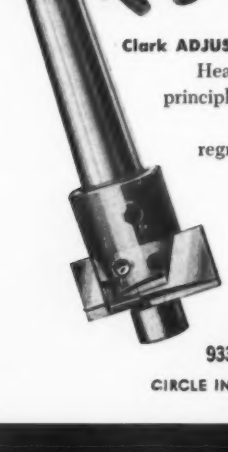
2 new Clark tools for HOLE-MAKING, SPOT-FACING, COUNTERBORING!



Clark HOLE-MILL—A high-production tool for precision, fixed-diameter holes! Removable head of M3-type high-speed steel cuts all materials, including alloy steels. Easy, accurate starts on crowned, irregular or webbed surfaces with piloted action. Makes single passes through thick stock; utilizes power feeds. Standard sizes: 1" to 4" diameter. Other sizes on order!



Clark ADJUSTABLE SPOT-FACER AND COUNTERBORE Heavy cuts, no chatter with unique shearing principle! Expandable M3-type high-speed steel blades quickly set to tolerance, easily reground. Piloted action. Excellent performance in Mills, Radials, Drills, Turret Lathes. Standard sizes: 1" to 4" diameter, others on order!

Write for full data, recommendations and prices!

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NOW! LATHE USERS CHANGE TOOLS in a ... FLASH ..

ALORIS QUICK CHANGE **TOOL POSTS & HOLDERS**
Speed Your Operation .... Save You Money

Only a second to change tools for turning, facing, drilling, boring, threading, knurling, cutting off or any other operation.

- **Great Repetitive Accuracy**
- **Rugged Construction**
- **Tested and Recommended by Leading Lathe Manufacturers**
- **Greater Rigidity**
- **Saves 90% in Set-Up Time**
- **Unconditionally Guaranteed**

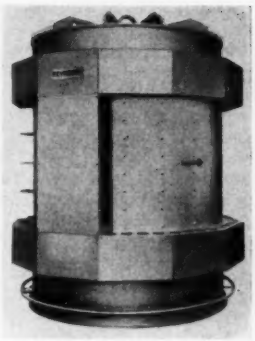
Write for catalog and price list.

ALORIS TOOL CO., INC. 419 Getty Avenue Clifton, New Jersey

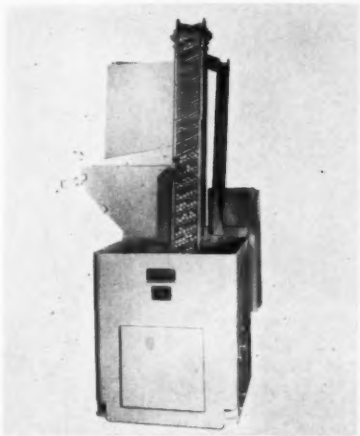
CIRCLE INFORM-A-GRAM KEY NO. 2144

Designed Specifically for marking thin wall cup-shaped parts or tubes is the automatic marking machine. Model 482 Dual-Dial machine roll marks permanent indents of part numbers into each work-piece at a production rate in excess of 5,000 pcs/hr. An emergency stop button and safety switch stops machine if a workpiece is not properly seated on the mandrel. The Noble & Westbrook Mfg. Co., E. Hartford, Conn., or — **Circle No. A13.**

A Wide Range of standard vacuum furnaces are available for either single or double pump vacuums. Layers of preformed and laminated insulation minimize heat losses and water cooled flanges perfect a vacuum seal between retort and furnace shell. These furnaces are used for refinement, heat treatment, and joining of materials. Hevi-Duty Electric Co., Milwaukee 1, or—**Circle No. A16.**

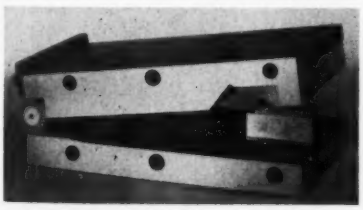


200 Ball Sockets per min are handled by an elevating conveyor and automatic parts feeder which orients and feeds them into a production machine. Feed rate can be adjusted by the moving conveyor which has a



variable speed drive. Low loading height and 4 cu ft capacity of the hopper afford simple conveyor loading and available parts storage. The unit (model 2200B) is portable and may be adapted to feed a range of rolling or sliding parts. Feedall, Inc., Willoughby, O., or — **Circle Inform-A-Gram No. A14.**

Establish Precise Angles for surface grinding, toolmaking, and inspection with the No. 925-5" sine plate. With an overall accuracy



within 0.0002", it gives angular settings gage block accuracy. The working surface of the hinged plate is 3½" x 6". Center distance between rolls is 5". Brown & Sharpe Mfg. Co., Providence, R. I., or — **Circle Inform-A-Gram No. A15.**

Chief of Engineers say:

"Heap big saving on die cost with

T-J CUTTERS!"

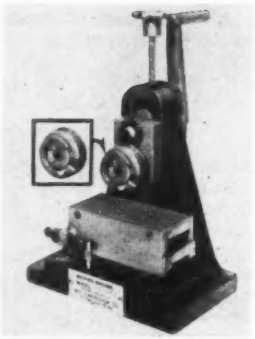
Smoke out facts—plain to see that Chief makes sense! T-J Cutters plenty rugged. Raise um feed. Reduce um die cost. Follow trail of many tribes—use T-J for tough die sinking milling. Chief knows you will like! Sign treaty now for T-J Cutters. Good medicine for high production, lower costs!

Yes, T-J makes the kind of he-man Cutters you need. Designed for speed, accuracy and long life . . . less breakage . . . more work between grinds! Made from an extremely high grade steel . . . properly machined . . . scientifically heat-treated and accurately ground. Wide range of styles and sizes. Send smoke signal or write for new catalog No. 1055. The Tomkins-Johnson Co., Jackson, Mich.

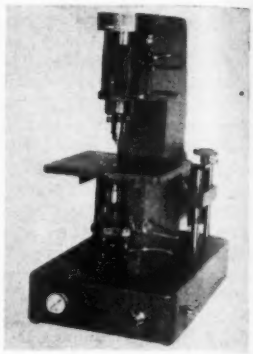
T-J TOMKINS-JOHNSON

CIRCLE INFORM-A-GRAM KEY NO. 215

The GRD Stamping Fixture has been modified to include an improved and simplified type change feature. It will handle flat stampings, hex plugs, sleeves, conical pieces, long bar parts, and channels. A spring-actuated ball lock feature now allows type to be changed easily during production runs. M. E. Cunningham Co., 1068 Chateau St., North Ave., Pittsburgh 33, or —
Circle No. A17.



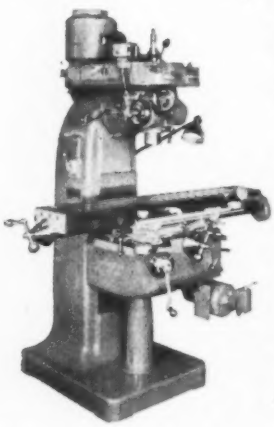
Deburring Both Sides of holes in flat and thin sections can be done with the alternating spindles on the Model vertical deburring machines. Holes 1/32" to 1/2" dia can be deburred in less than half the time of previous methods. The machine is air operated through double acting cylinders and foot controlled. Model Machine Co., Inc., 4729 Hawthorne St., Philadelphia 24, or —
Circle No. A18.



Produce MORE...
Produce it BETTER!
ON THESE IMPROVED ECONOMICAL
INDEX VERTICAL MILLS

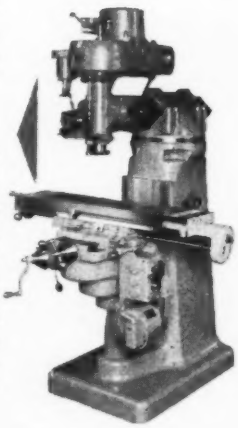
Super "55" MILL

1½ HP Head or optional 2 HP with continuous duty motor gives 50% or more capacity . . . More rigidity, more accuracy . . . Increased horse power and dynamically balanced Cast Iron Pulleys and Drive System afford improved production capacity . . . More weight in the column, heavier ribbed column, heavier knee, heavier saddle.



Unique square design of overarm affords more rigidity, greater accuracy . . . Provides extra range and capacity . . . More power at the cutter. No adjustment required on overarm and head after use . . . No need to re-indicate head after moving overarm . . . Speed range with nine changes makes possible the use of high speed or carbide tipped cutters to best advantage.

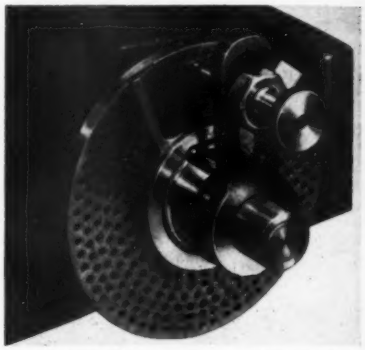
"45" MILL



INDEX MACHINE CO.
541 N. MECHANIC STREET JACKSON, MICHIGAN

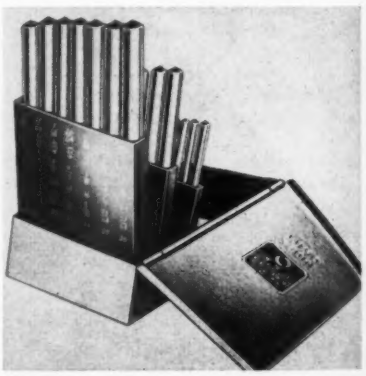
CIRCLE INFORM-A-GRAM KEY NO. 216

A New Dividing Attachment for use with its line of rotary tables has been announced by the Universal Vise and Tool Co., Parma, Mich. The dividing attachment fits all models



of Universal's rotary tables. Divisions obtainable are 2 to 63 inclusive and 27 additional divisions to 100. Other divisions are obtainable by formula.
Circle Inform-A-Gram No. A19.

High Speed Drill Blanks are used for trying holes and for punches, gages, and stock for making special tools. This line of drill blanks are made in corresponding lengths as



jobbers', wire, and letter size drills and finished to the same tolerance. The size range is complete in fractional, letter, and wire gauge sizes. Chicago-Latrobe, 411 W. Ontario St., Chicago 10, or —
Circle Inform-A-Gram No. A20.

FOR THE "HOLE" FIELD

NEW CONCEPT IN AUTOMATIC DRILLING AND TAPPING UNITS

MODEL 500
DULL TOOL LITE
AND
SUB-BASE

AUTOMATION | DRILLMATION | TAPMATION

Drillmation's hydraulic, locked-circuit feed Drilling and Tapping Units are the finest and most completely self-contained of any similar unit available today. Drillmation also offers more essential and exclusive features. Write TODAY for literature.

12 ESSENTIAL Exclusive FEATURES in 1 Unit

- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
- **THRUST CONTROL** Maximum thrust may be set to protect tools. Will not surge at break point.
- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
- **COOL OPERATION** Low volume high pressure hydraulic pump used on power stroke only. Air power used for rapid traverse.
- **PRODUCTION MACHINE** Mount in any position. Quiet operation. Self lubricating.

DRILLMATION

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6500 E. ELEVEN MILE ROAD
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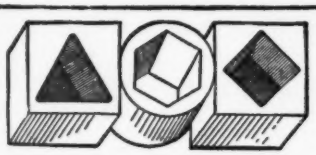
CIRCLE INFORM-A-GRAM KEY NO. 2171



DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 2172

CAMS
To Your Specifications
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— Except Screw Machine Cams —
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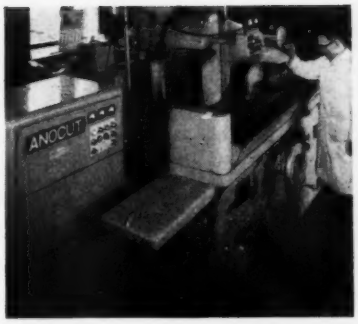
Design Assistance Offered
KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2173



if we can't cut your grinding costs . . . . . we'll say so!

But We Usually Cut Them By 85-90%!

Where there is room for improvement — in abrasive costs, removal rates, finish — we will be the first to help you investigate thoroughly the advantages of Anocut Electrolytic Grinding. Should our process be adopted, our engineering service department will keep in close contact with you, continually striving for further improvement.

For these reasons, all users of Anocut Electrolytic Grinding are realizing significant economies over their previous or alternate grinding methods. In fact, over 50% of our output is sent to satisfied customers who are continually reordering.

Listed in coupon are those materials with which we have had much success. Check those you are interested in for literature and data.

ANOCUT®
Engineering Company
631 WEST WASHINGTON
CHICAGO 6, ILLINOIS

Send me information on Electrolytic Grinding of:
( ) Carbide tools and cutters
( ) Hardened steels
( ) Honeycomb
( ) High temperature alloys
( ) Other
( ) Have a Representative Call

Name_____
Company Address _____
City_____ State _____

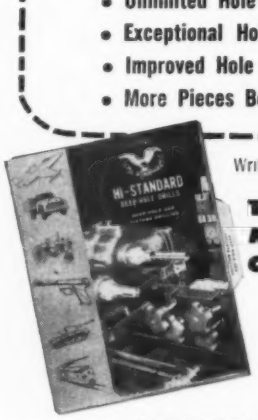
CIRCLE INFORM-A-GRAM KEY NO. 2174

DRILLING COSTS TOO HIGH?

In Steel . . . Stainless . . . Brass . . .
Aluminum . . . Titanium . . . and Wood

HI-STANDARD Deep-Hole Drills give you . . . at lower cost . . .

- Exacting Hole Diameters
- Unlimited Hole Depth
- Exceptional Hole Concentricity Throughout
- Improved Hole Surface Finish
- More Pieces Between Grinds



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THE HIGH STANDARD MANUFACTURING CORPORATION
Hamden, Connecticut

Pioneers and Makers of Deep-Hole Drills For More Than 30 Years

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It's NEW! **3000 SERIES BURR-RITE Sr.**

NEW MACHINE NEW MEDIA Reduce Your Deburring Costs

● Is DEBURRING required on your products? Do you realize the savings that can be made by the Barrel Finishing process? Write us today and get full details about this new, improved machine. SEE its value on your parts . . . Send samples for free processing today.

Globe Div. CASALBI CO.
547 Wayne St., Jackson, Michigan
Barrel Finishing Equipment • Media • Compounds

CIRCLE INFORM-A-GRAM KEY NO. 2183

REPEATED ACCURACY WITH Em-re DIAL INDICATORS

THE MOST ACCURATE MADE

Patents Pending.

The "Em-re" Dial Indicator will give you greater accuracy, greater repeatability and longer service-life than ever before possible. This precision performance results from a unique combination of design features: the "Em-re's" simple, unit construction consisting of only 31 parts, 25 of which are interchangeable and common to all models — a fully jeweled gearing mechanism — and a completely shockproof system, throughout the *entire* range, that *actually contributes* to the measuring accuracy obtained. Rigid testing with millions of severe impacts has failed to impair even slightly this repeated accuracy (to better than .00002" in .00005" and .0001" indicators). Stocked in 26 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". *Also available for accurate indicator testing — The "Master" Dial Indicator Checker.*

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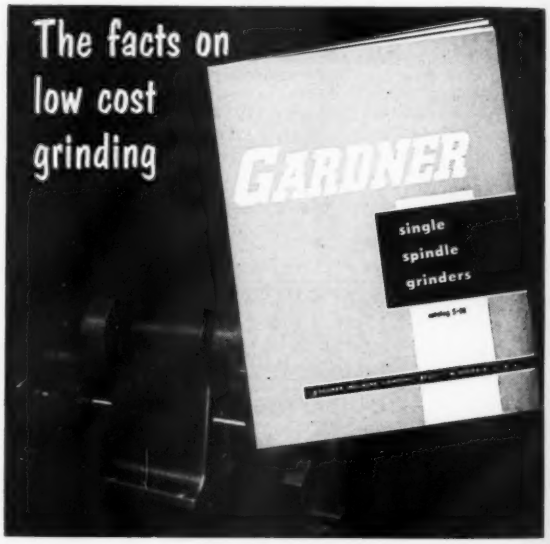
PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 2182

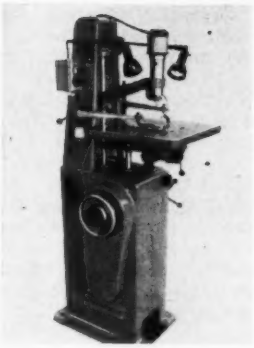


16 page catalog S56

GARDNER MACHINE COMPANY
416 Gardner St., Beloit, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 2184

Rotary and Reciprocating motions are available simultaneously with the Roto Recipro toolmaking machine. All types of tool steels, carbide form cutting tools, contoured tungsten carbides, and hardened steels can be machined. The fluted work table is 18" x 18" and is ground and flash chromed for wear. Connecticut Tool & Engineering Co., Round Hill Rd., Fairfield, Conn., or **Circle No. A21.**

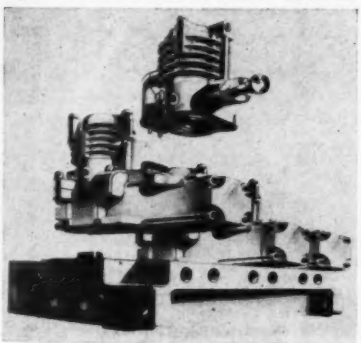


The Combination of light weight with high strength for aircraft and missile applications under extreme environmental conditions is a feature of titanium Hi-Shear rivets. They are available in productions quantities in a full range of sizes. Rivets in other materials are also available. Hi-Shear Rivet Tool Company, 2600 W. 247th St., Torrance, Calif., or—**Circle No. A24.**

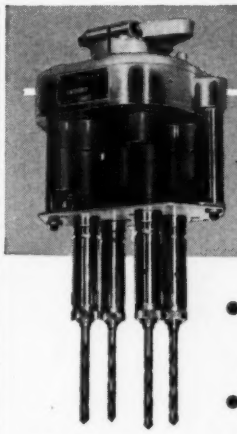
Capacity for Reamers of ¼" to 1½" Dia is one of the features of the bench-mounted reamer driver. This unit has four speeds, 20, 32, 56, and 85 rpm, with higher speed ranges available on special order. Foot

switch operation leaves the operator's hands free to control the work and convenient bench height facilitates handling. Steady, low-speed rotation of the reamer driver assures smoothly reamed holes. The Greaves Machine Tool Co., Eastern Ave., Cincinnati 2, or —
Circle Inform-A-Gram No. A22.

A Line of Speed King plug-in type ¼" 4-way control valves are fitted with built-in plugs and connectors. Available in both single and double solenoid types, for manifold or subbase mounting, the valves are designed for control of smaller devices.



Plug-in connectors built into pilot, valve body, and manifold or subbase complete electrical connections as components are bolted in place. Valvair Corp., 454 Morgan Ave., Akron, O., or —
Circle Inform-A-Gram No. A23.



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Adjustable, Multiple-Spindle Drill Head

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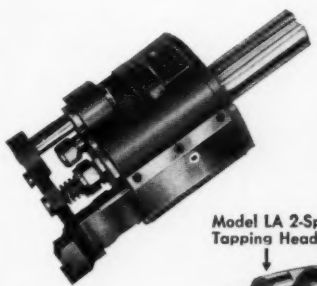
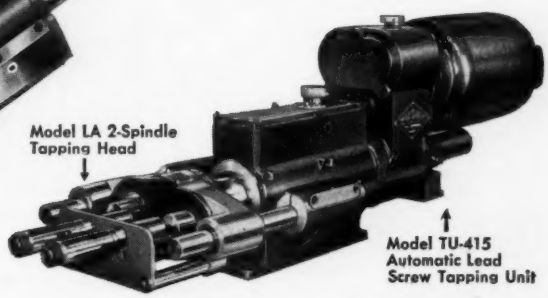


Wisconsin Rotating Drill Head with planetary gear drive



Model LA 2-Spindle Tapping Head

Model TU-415 Automatic Lead Screw Tapping Unit

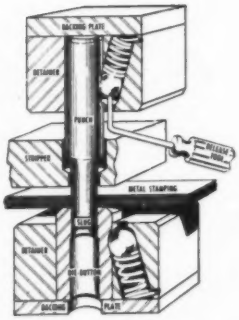
Write for Illustrated Literature

WISCONSIN DRILL HEAD CO.

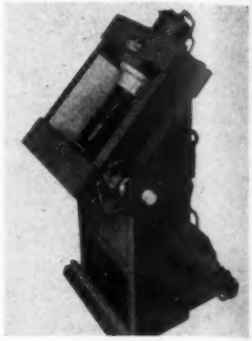
4975 124th STREET • BUTLER, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 219

A Line of Ball Lock Punches and Die Buttons is available from Acme Industrial Products, Inc., P.O. Box 468, Royal Oak, Mich. The ball lock design enables quick interchangeability for resharpening or replacement and the die need not be disassembled. Supplies include 543 sizes and types of standard punches, 1,063 of standard die buttons, and 53 of punch and die retainers. **Circle No. A25.**



Greater Operating Convenience is an advantage of the improved swaging machine announced by the Weatherhead Co., Fort Wayne Div'n, Fort Wayne, Ind. Positioned at a 45° angle it permits easier handling of large size, long length hose assemblies. This change makes a more compact unit with controls, gages, and work center all on the same visual plane, and requires less installation space. **Circle No. A26.**



FOR EASY, FAST, UNIFORM SEPARATION OF DIE SETS . . .

Use These Acro Pullers

When you have die set pullers that remove the punch holder from the die shoe by a straight upward pull and the punch holder slides upward from the die shoe simultaneously from both leader pins, you have Acro Die Set Pullers and you're saving time.

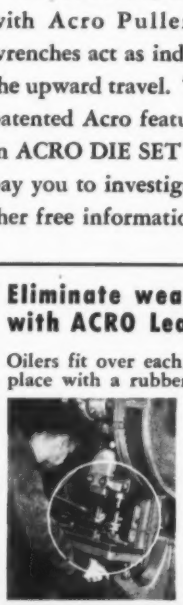
If you're not, this is how it's done with Acro Pullers: *Indexed* screw wrenches act as indicators, controlling the upward travel. This is an exclusive patented Acro feature and found only in ACRO DIE SET PULLERS. It may pay you to investigate. Write for further free information today.

Separate die sets with even upward pull.

Die sets separate evenly and smoothly.

Eliminate wear on Die Sets with ACRO Leader Pin Oilers

Oilers fit over each leader pin, seal in place with a rubber neoprene washer. Each cup is filled with oil so each downward stroke brings bushing in contact with oil and each upward stroke distributes oil evenly over leader pins. Write for additional information.

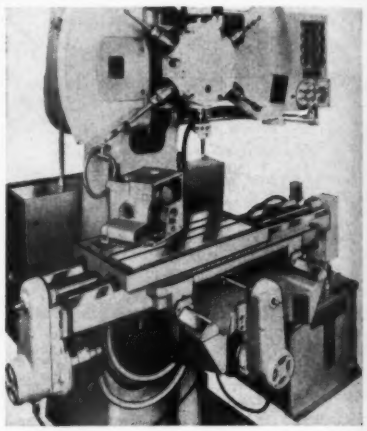


OTHER ACRO TIME SAVERS FOR YOUR SHOP include drill rod racks, wing nuts and lubricators. Write for complete descriptive folder. Ask for DP-57.

ACRO METAL STAMPING CO.
336 E. RESERVOIR AVE., MILWAUKEE 12, WIS.

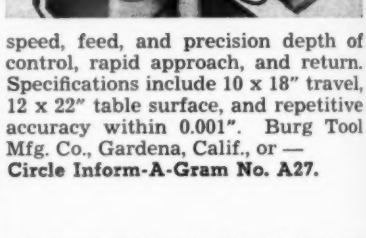
CIRCLE INFORM-A-GRAM KEY NO. 220

An Automatic Tape controlled table is an accessory to the Burgmaster multiple spindle turret drill. Each spindle is controlled individually by the standard Burgmaster in



speed, feed, and precision depth of control, rapid approach, and return. Specifications include 10 x 18" travel, 12 x 22" table surface, and repetitive accuracy within 0.001". Burg Tool Mfg. Co., Gardena, Calif., or — **Circle Inform-A-Gram No. A27.**

A Steel Bolt with plastic locking action locks wherever wrenching is stopped, and is vibration proof, liquid tight, and adjustable. Locking takes place by means of a permanent nylon plug in the side of the bolt. The nylon plug wedges opposite mating

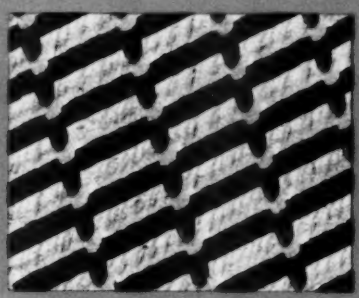


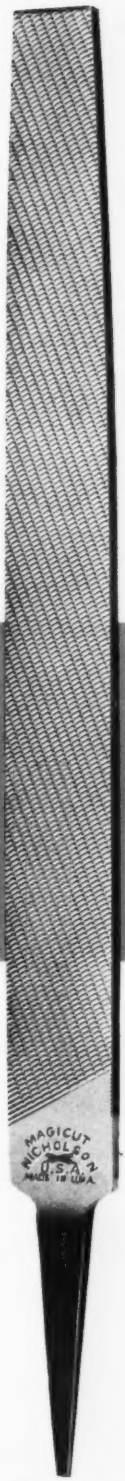
threads together, and locks whether or not the bolt has been seated. It is available in sizes from No. 10 to 1" dia. The plug is resistant to moisture, ordinary solvents, and provides permanent seal. Bolt & Chain Div'n, Republic Steel Corp., 1970 Carter Rd., Cleveland 13, or — **Circle Inform-A-Gram No. A28.**

They're all the same to

MAGICUT

NICHOLSON'S NEW ALL-PURPOSE MACHINIST'S FILE





If you haven't tried the new Magicut, you've missed a very unusual new file. It's a Machinist's file—with a brand new kind of teeth. The teeth are Penetrating Planer-Type. They're created by using steep-angled serrations to get lots of narrow chip breakers.

Magicut is super-efficient. It works its magic on whatever industrial metals you use—cuts quickly by biting into the material being filed then leaves a smooth finish. Stock removal and smoothing are made easy with the new Magicut. It roughs and smooths—*in one operation.* You can get this fine new file in Flat, Half Round and Square shapes in sizes shown at right.

Ask your Industrial Distributor to show you the Magicut. You'll like this new file—and your Distributor can supply it to you quickly from his complete line.

Which of these sizes can you use?

MAGICUT FLAT

8-inch 12-inch
10-inch 14-inch

MAGICUT HALF ROUND

8-inch 12-inch
10-inch 14-inch

MAGICUT SQUARE

8-inch 12-inch
10-inch 14-inch

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A FILE FOR EVERY PURPOSE

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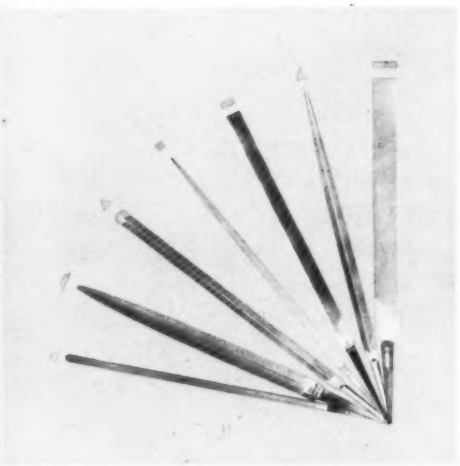
precision-made for precision workers



X.F. Swiss Pattern files are the kind of tools skilled workers appreciate because the craftsmanship we put in them shows in the way they feel and the results they give. There are no finer files.

They're made to precise measurement. Their shapes are results of long study by Nicholson researchers. You can get X.F. (*Extra Fine*) Swiss Pattern files in dozens of shapes and sizes for precisely the job you want to do well. And you'll get 12 perfect files in every dozen.

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Large Precision Machining
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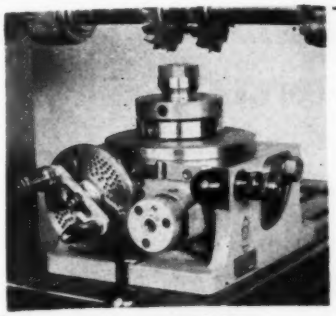

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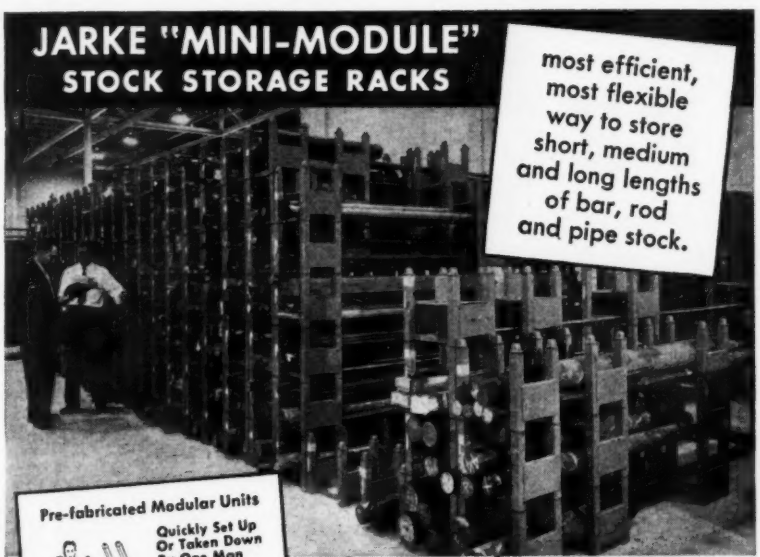
JARKE "MINI-MODULE" STOCK STORAGE RACKS

most efficient, most flexible way to store short, medium and long lengths of bar, rod and pipe stock.



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Quickly Set Up Or Taken Down By One Man
No Bolts
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Special nesting caps permit fast stacking, insures rigid no-slip vertically interlocked tiers. Stock them to exactly fit your needs. Heavy-duty tubular steel construction.

Send for details and FREE set of miniature plastic Mini-Modules for easy storage planning.

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SPECIAL SIZE GAGE BLOCKS by JANSSON

in either English or Metric measure

You specify size, shape and needed accuracy. Sizes range down to .004" thickness; accuracies to ± .000001". Swedish trained craftsmen, using Swedish optical gage block comparators and the latest electronic measuring equipment, will validate their sizes. Materials used are special alloy gage block steel, tungsten carbide, cemented carbide, chrome carbide, chrome plated or other commonly used alloys. These materials are scientifically seasoned by Jansson's special process to assure absolute stability.

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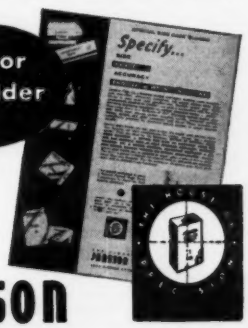

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13550 AUBURN AVENUE
DETROIT 23, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2235

Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

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– whenever your duplication requirements call for the standard tool items illustrated here. Stocks at ECONOMY are always complete – assuring you of quality and service.

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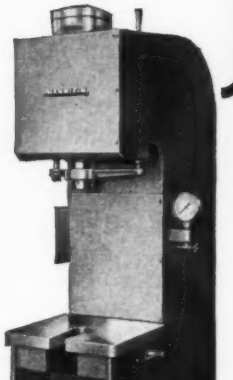
PRICE LIST

ON HANNIFIN STOCK HYDRAULIC PRESSES



1-TON, Bench Type	$ 605
2-TON, Bench Type	$ 680
5-TON, with Base	$1,530
8-TON, with Base	$1,605
10-TON, Floor Type	$2,290
25-TON, Floor Type	$3,790

Prices complete with motors and starters F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

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Demand for these popular presses is so consistent we are able to produce them in quantity and pass the savings along to you.

Construction-wise and quality-wise these small general-purpose presses are identical to the larger Hannifin presses, up to 150 tons. Special, optional controls when needed.

WRITE for complete information on the Hannifin Hydraulic Press you're interested in.

HANNIFIN

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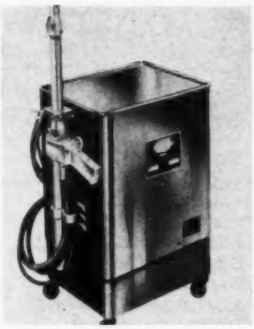
An Economical and Accurate Method of broaching on the assembly line is with the Porto-Broach. Assemblies may be broached in position, on a high production basis without the use of fixtures or bushings. Round holes 3/16" to 1½" dia and other shapes can be broached to ±0.0002" tolerances. Pioneer Broach Co., 6434 E. Telegraph Rd., Los Angeles 22, or —
Circle No. A29.



As Many as 2,000 pieces of pipes and tubes ranging in size from 3/8" to 1¼" OD in light gauge to 16-gauge wall thickness, can be cut per hr on an air operated rotary cut-off machine. Rotary cutting provides fast cutting because its action is through the wall thickness rather than the entire diameter of the material. Continental Machine Co., 1952 N. Maud Ave., Chicago 14, or —
Circle No. A32.

Two Large Rotary Inductosyns have been announced by Farrand Controls, Inc., 4401 Bronx Blvd., New York 70. These comprise a 7" Rotary Inductosyn with an accuracy to 2 sec of arc and a 12" unit with accuracy to 1 sec of arc. Both are

360-pole, 180-speed. The unit can be used as an electromechanical dividing head, a multi-speed data transmission system, a high precision position servo, an electronic backlash free gear ratio, and a high speed electromechanical phase shifter.
Circle Inform-A-Gram No. A30.

End Mills specifically designed for aluminum and other non-ferrous materials are now available in standard sizes from Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich. Included in the Fastlead series are

regular and long length mills in diameters of ¼" to 2". Extra long length mills are standard in diameters of ¼" to 1½". The flute design and a high helix angle insure positive chip removal and the relief affords stronger, more durable cutting edges.
Circle Inform-A-Gram No. A31.

New
ARMSTRONG
Armide CARBIDE INSERT
TOOL HOLDERS

STYLE SR
(opposite Hand SL)
Holds square, 8-edge, Armide and other carbide "throw-away" inserts.
ARMSTRONG CHICAGO U.S.A.
Buy ARMSTRONG TOOLS from your Industrial Distributor

Embody...Convenience, Economy Simplicity and Strength based on these superior features:

- IMPROVED CLAMPING METHOD — speeds indexing of Inserts.
- REPLACEABLE SEAT of Hardened Tool Steel — protects shank and provides flat base to prevent damage to inserts as they are clamped in position.
- SHANK of Heat Treated Alloy Steel — gives extra strength and rigidity.

A slight turn of a single screw permits rapid indexing of the ARMIDE insert — reducing down time to a minimum.

The use of ARMIDE "throw away" inserts provides the economy of multiedged inserts — triangular inserts have six, square inserts eight cutting edges. These are available in Utility or Precision finish and in three grades of ARMIDE: 350, 370 or 883.

Protection to the shank is given by the replaceable tool steel seat which prevents wear and damage to the shank and provides a flat base for the insert reducing the possibility of damage to the insert as it is clamped in place. A relief groove is ground into the seat providing clearance when a dulled insert with "built up" edges is turned over.

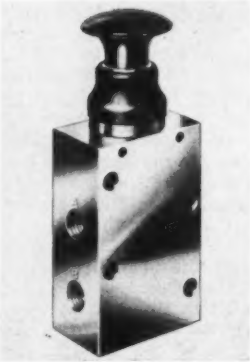
ARMSTRONG ARMIDE Carbide Insert Tool Holders are furnished in two styles and three sizes. Complete data on these tools is given in Bulletin CIT, mailed on request.

Write for catalog

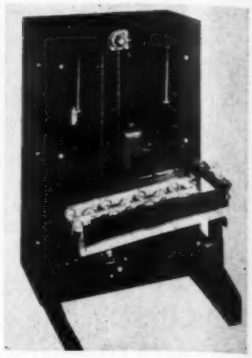
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 225

Increase Valve Life with the improved Flo-Pilot series valves. They have a small synthetic rubber boot which snaps in place around the valve stem, sealing all critical parts from dirt and abrasives. The basic valve has 5 optional actuating heads — palm button, ball cam, lever, locking lever, and mechanical link clevis. Hanna Engineering Works, 1765 Elston Ave., Chicago 22, or — **Circle No. A33.**



A Vertical Transfer Unit reverses the direction of material flow without use of 180° curved conveyor sections, and can operate in limited space. This direction change is accomplished by a vertical lift which operates as a self-supported, automatic unit. Capacity ranges are from light to medium loads. The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich., or — **Circle No. A34.**



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AIR TURBINE GRINDER

The 50,000 RPM ½ HP Onsrud D1-GB Air Turbine Grinder shown here, mounted on a lathe, provides surface finishes of 3 to 4 RMS in internal and external surface grinding operations. Construction features include pre-loaded bearings and dynamically balanced spindle. Governor control maintains full power and speed under load . . . gives air economy at idling.

For a total cost of less than $200 a precision-built Onsrud Air Turbine Grinder can be yours for low cost precision internal and external grinding on your lathe or similar machines. You'll find Onsrud Grinders have the extra power, speed and precision to more than do the job. Write for D1-GB Air Turbine Grinder Bulletin.

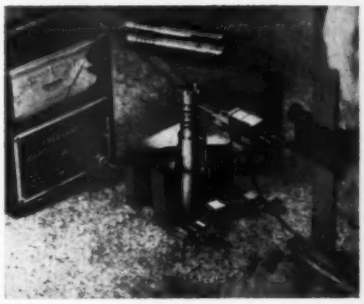
ONSRUD MACHINE WORKS, INC.
PORTABLE TOOL DIVISION
3941 Palmer Street
Chicago 47,
Illinois

Onsrud® quality AIR TURBINE TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 226

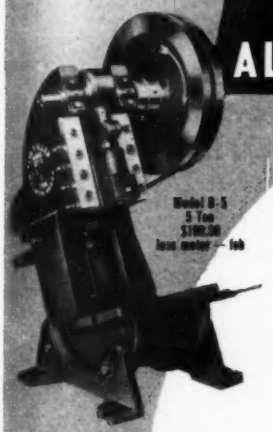
Speed Up Multiple Drilling and Tapping Operations with Govro-Nelson automatic drilling and tapping units. The two-position machine incorporates two vertical and five horizontal units for drilling and tapping 12 holes in three similar parts. Two holes are drilled in one position and ten holes are tapped in the second position. The machine's output is 300 pcs/hr. Govro-Nelson Co., 1933 Antoinette, Detroit 8, or — **Circle Inform-A-Gram No. A35.**

An Electronic Test Indicator is quickly applied to precision measurement on a surface plate or machine and is particularly suited to general inspection and patrol inspection applications. Transistor operation permits the unit to be completely independent of external power. The model 230P-2 includes the Electro-Probe gage head whose method of electro-magnetic operation provides unusual operating capabilities. Federal Products Corp., Providence, or—**Circle Inform-A-Gram No. A36.**



A Liquid Spring using liquid compressibility has been announced by Taylor Devices Inc., 188 Main St., North Tonawanda, N. Y. This miniature ½" dia liquid spring develops 800 lbs force at ¼" stroke with an 80-lb preload and is only 2" long. The spring reduces die costs by permitting simultaneous operations to be designed into compound dies thus reducing the number of single purpose dies. They also reduce the size and cost of dies by decreasing the required number of drilled and tapped holes.
Circle Inform-A-Gram No. A37.

Heavy Duty Bench Type ALLEN PUNCH PRESSES

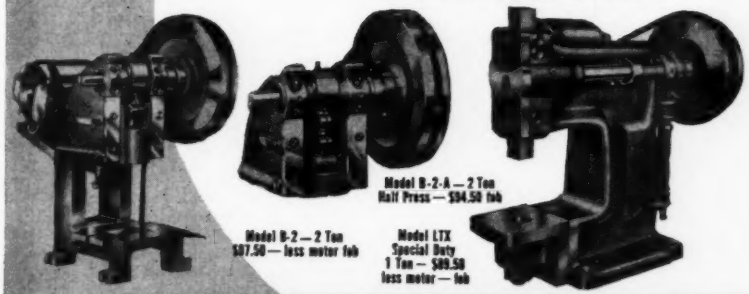


Moderate in Price
Powerful
Dependable and Economical
Fully Guaranteed

164 Different Model Combinations 1 to 5 Ton Capacities

See your Supply Dealer or write for Catalog giving complete information, specifications and prices on our line of Bench Type Punch Presses.

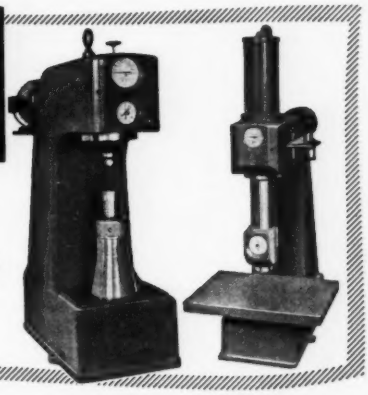
Thousands in use by Leading Manufacturing Companies



ALVA ALLEN INDUSTRIES Dept. TP Clinton, Mo.

CIRCLE INFORM-A-GRAM KEY NO. 2271

For the best, buy
DETROIT
Testing Machines



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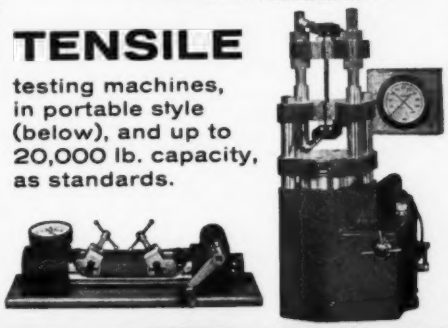
hardness testing machines in many standard models. Special models too.

DUCTILITY
testers for sheet metal are hydraulically powered, have 3/16-inch capacity.

TENSILE
testing machines, in portable style (below), and up to 20,000 lb. capacity, as standards.



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DETROIT TESTING MACHINE COMPANY

Grinnell Avenue, Detroit 13, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2272

FORD
rotary tools

WHY THEY DO YOUR JOB BETTER

All Ford files H. S. S. and carbide cutters are *precision machine ground* . . . which insures that tooth spacing is uniform and relief angles are constant on each tool. Ford files are handcut by precision craftsmen. On your job, that means more parts per grind. So you save labor on grinding and tool changing. You save on replacements. You save on downtime. What's more, there's less time per part, more parts per hour. In 7 shapes . . . cutting head sizes from 1/8" to 1" diameter, up to 1 3/8" in length. All standard, and *available* in H. S. S. or solid carbide.

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817 W. RIVER STREET, DAVENPORT, IOWA

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DIATEST High Precision BORE GAGE

Eliminates Need for All Special Hole Gages!

MEASURES ALL BORES

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Barrel Shaped,
Incomplete Bores, etc.

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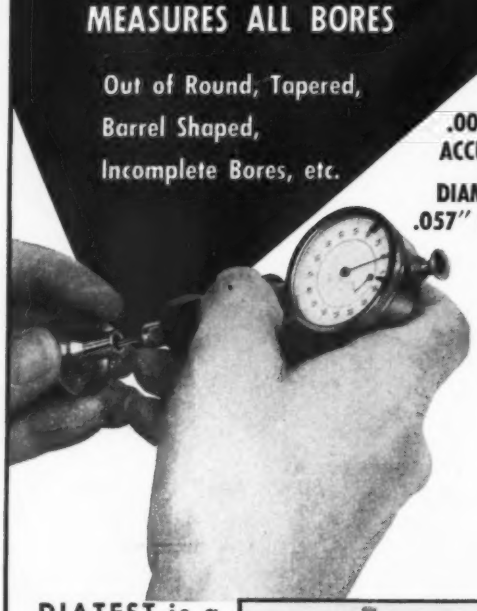
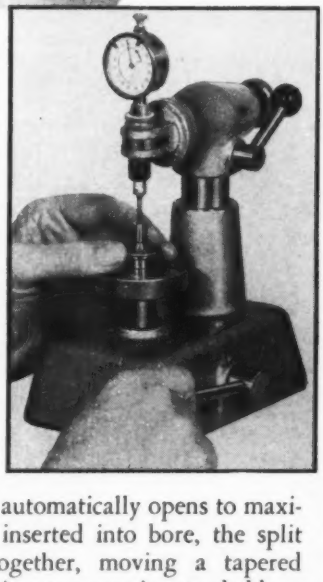
DIAMETERS .057" to .828"





DIATEST is a complete comparator gage with rings and measuring heads built around a ten-thousandths dial indicator.

The measuring units are split ball type, made of highly tempered chromium plated steel. When instrument is not in use, split ball unit automatically opens to maximum size. When inserted into bore, the split ball is pressed together, moving a tapered needle upward. This movement is recorded by a dial indicator with continuous readings within .0001"

All units and sets overlap in size to insure complete range.

For Additional Information, Write:

FOSTER SUPPLIES CO.

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CIRCLE INFORM-A-GRAM KEY NO. 2281

You **KNOW** where the holes will be...with

UNIVERSAL ADJUSTABLE

U.S. Drill Heads

"Shot gun accuracy" is for the birds. With U. S. Heads you pin-point your multiple-hole drilling *exactly*—position the drilling spindles for different patterns almost as easily and quickly as you read them from your prints.

Style U-1L Universal Adjustable Head provides 9" diameter drilling area. U. S. Heads cover a wide range—6" to 15" diameter drilling areas, drill sizes up to 1-1/16". Totally-sealed, lifetime-lubricated universal joints can be interchanged quickly without tools.

Immediate delivery on most sizes. Write today for complete specification data in new catalog No. AD-57.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads.

US DRILL HEAD — UNITED STATES DRILL HEAD CO.

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USE **A.I.T.** Diamond Wheels for all Carbide Grinding

RESIN B-60 Cup Type Diamond Wheel

TYPE DIIB

The exclusive B-60 Bond used in A.I.T. bonded diamond wheels has been field tested in over 400 plants. We can *prove* these superior advantages to you in YOUR plant:

- **Faster grinding**
- **Up to 40% longer wheel life**
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- **Wheel grinds cooler—does not fracture carbide**
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- **NEW BACKING dissipates heat faster**
- **No down-time for dressing inside body section**

Write today for new, FREE catalog and prices

A.I.T. Diamond Tool Co.

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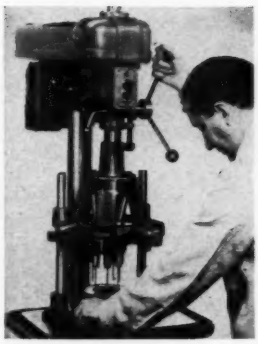
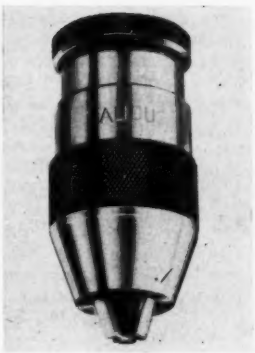
CIRCLE INFORM-A-GRAM KEY NO. 2283

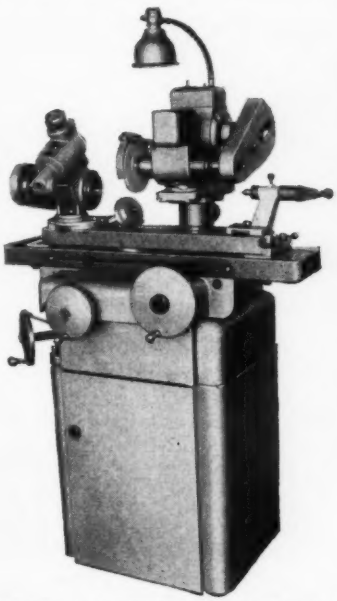
Accurately Drill or Tap over a million different hole combinations with model 600 six spindle circle type head. It will run at top speed in any operating position in either direction without vibration. They can be quickly located anywhere within a 3" dia with a 15/16" minimum center distance even while the unit is running. Ettco Tool & Machine Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y., or —
Circle No. A38.



Unparalled Accuracy of concentricity is the outstanding feature of the precision Keyless drill chuck-type Validus, one of a line of R. B. drill chucks. Sealed ball bearings allow for the easy opening and closing by hand. All working parts are hardened and carefully ground. The drill chuck is available in 4 sizes from the R. B. Tool Co., 785 N. Broadway, White Plains, N. Y., or
Circle No. A41.



Improved Accuracy Standards, greater capacities, 25% heavier construction, V-type saddle, and larger table ways are some of the features of the Model B960 universal tool

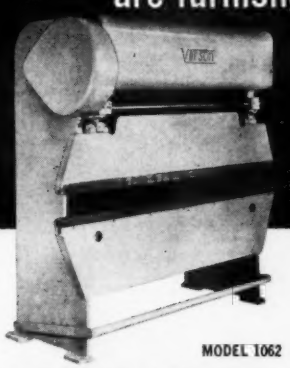


grinder. It is equipped with dovetail slide mounted multiple speed head, and an improved lubrication system giving longer life. The distance between head and tail stocks is 20¾" and the swing over the table is 8¼". K. O. Lee Co., Aberdeen, S. D., or —
Circle Inform-A-Gram No. A39.

Profile Widths up to 6" and profile depth up to 3½" are handled by the model 86 hydraulic contour wheel dresser for use on cylindrical grinder. The dressing diamonds are optically set in the microscope fixture so that no dresser adjustments are necessary when changing diamonds. Hydraulically operated, the machine may be tied directly into the grinding cycle for fully automatic operation. Where applicable, uniform peripheral diamond dressing speed is possible. Hoglund Engineering and Mfg. Co., 343 Snyder Ave., Berkeley Hts., N. Y., or —
Circle Inform-A-Gram No. A40.

TWO MODELS–NO WAITING

These Verson Power Press Brakes are furnished from stock



MODEL 1062

$2630*

is the full price of this Verson quality press brake, designed and built for top performance. 16 ga. x 78" capacity.

MODEL 16-48

$1600*

will put this power press brake to work in your shop in a matter of days. Capacity is 16 ga. x 48" of mild steel.

Large shop . . . small shop . . . here are economical answers to a wide variety of bending jobs in any shop. Models 1062 and 16-48 are standard Verson Press Brakes available from stock without the annoyance of involved proposals or long delays in delivery.

Here's the chance to put famous Verson all steel construction and proved-in-service Verson design to work for you . . . at a price so attractive, it's hard to believe. Write for complete specifications or if you prefer . . . place your order NOW!

*Prices F.O.B. Chicago, less dies; subject to change without notice.

A Verson Press for every job from 60 tons up. 164

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VERSON ALLSTEEL PRESS CO.

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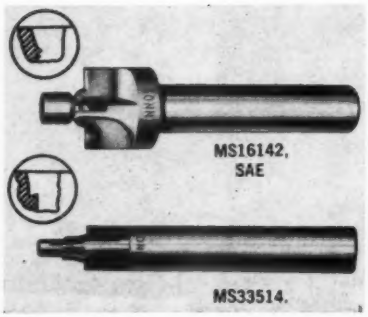
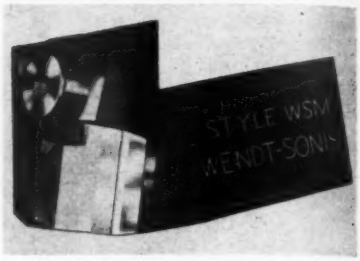
CIRCLE INFORM-A-GRAM KEY NO. 229

Standard, Carbide-Tipped Port Contour Cutters for profiling the MS33514 flareless tube connector contour and the MS16142 internal o-ring boss for straight thread tube fittings are now available. Both new tools form a complete contour as the tool is fed into a drilled hole. The carbide flutes provide long cutter life, smooth finish, and a maximum number of cuts per grind. The new cutters are available in 13 diameters for all sizes of fittings used with ⅛" through 2" dia tubing. Sonnet Tool and Mfg. Co., 578 N. Prairie Ave., Hawthorne, Calif., or — **Circle Inform-A-Gram No. A42.**



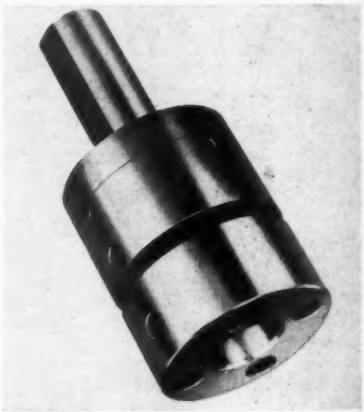
The Roller Turner Tool Holder cuts to a 90° shoulder and can be used with 0° lead. Machine downtime is cut to a minimum, because cutting edges can be changed in seconds by unclamping and indexing the carbide



insert. Inserts can be indexed to ±0.001" so adjustments for depth and length of cut are unnecessary. Because one screw adjustment is used to set the cutting edge on center, setups are made easier and faster with the new tool holder. Wendt-Sonis Co., Hannibal, Mo., or — **Circle Inform-A-Gram No. A43.**

Pneumatic Spray Systems atomize oil in a nozzle of a spray valve by compressed air. These systems can be applied to milling, drilling, sheet stock oiling hot chains, cams, etc. They may be used for gravity, syphon, air or pump operated systems, and are of the external mixing type which reduces oil fog to a minimum. Oil-Rite Corp., 2332 Waldo Blvd., Manitowoc, Wis., or — **Circle Inform-A-Gram No. A44.**

Engineered to Insure True Center precision drilling, reaming, and tapping operations is the adjustable tool holder for turret lathes. The Repco holder is designed for quick, easy positioning of tools on true-center and to compensate for as much as



1/32" misalignment. Dead center settings are made by simply adjusting positioning set-screws and tightening locking cap screws. Four standard holders are provided in bore and shank diameters of ¾", 1", 1½", and 1¾". Rockford Engineered Products., 2324 - 23rd Ave., Rockford, Ill., or—**Circle Inform-A-Gram No. A45.**

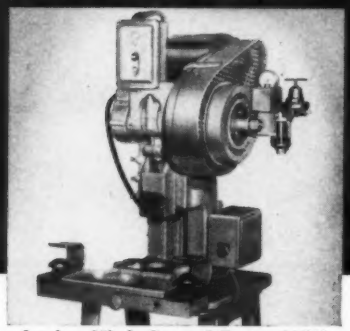
PERKINS *Junior* PRESSES

DEPENDABLE
VERSATILE
TOP PERFORMANCE

The Perkins Junior is a precision built machine. Costly dies can be run in these little presses with perfect confidence. A variety of frames is available giving whatever die space may be required.

Junior Press With Roll Feed

The use of a feed roll will tremendously increase production. An accurate feed roll is available for Perkins Junior presses. The Junior roll feed will take material up to 2" in width and feed from 0 to 3¾". The feed can be mounted on a bolster plate and easily attached to the press. Special feeds for wire are available as well as for extra long work.



Junior High Speed Press With Combination Air Clutch and Brake

This is the latest advancement in small press design and performance, it gives:

- Single tripping with speeds up to 600 rpm with dual hand buttons for safe, fast production.
- Continuous running with adjustable top stop control.
- Less maintenance—no clutch dogs or wheel inserts or springs to replace.
- Surprisingly low cost for the complete unit.

Investigate this latest advancement in a fast, safe press.

PERKINS MACHINE COMPANY
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20 PERKINS STREET, WARREN, MASS., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 230

DESIGNERS
for COMPARATIVE AND ULTIMATE STRENGTH TESTS, ETC

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Torque Testing FIXTURE

A universal fixture with 1000 uses. Holds driver in accurate alignment; in instrument bearings. Provides rapid engagement with test sample...torque is applied and measured with Sturtevant Torque Wrench.

Model TTF¼ *Capacity* **0-200 in. lbs.**
Model TTF½ *Capacity* **0-150 ft. lbs.**

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ADDISON QUALITY ILLINOIS

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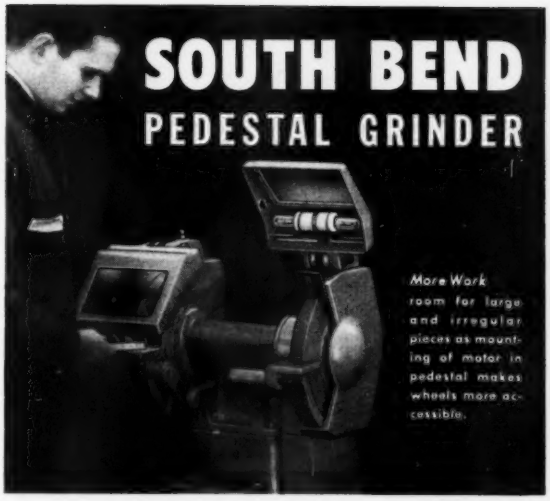
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PEDESTAL GRINDER
More Work room for large and irregular pieces as mounting of motor in pedestal makes wheels more accessible.

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- √ Safety glass shields with built-in lights.
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- √ Ruggedly built for long, dependable service.
- √ 8" or 10" wheels—*prices start at* $268.

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Up to 24 months to pay.

SOUTH BEND LATHE South Bend 22, Indiana
Builders of lathes, milling machines, shapers, drill presses, pedestal grinders

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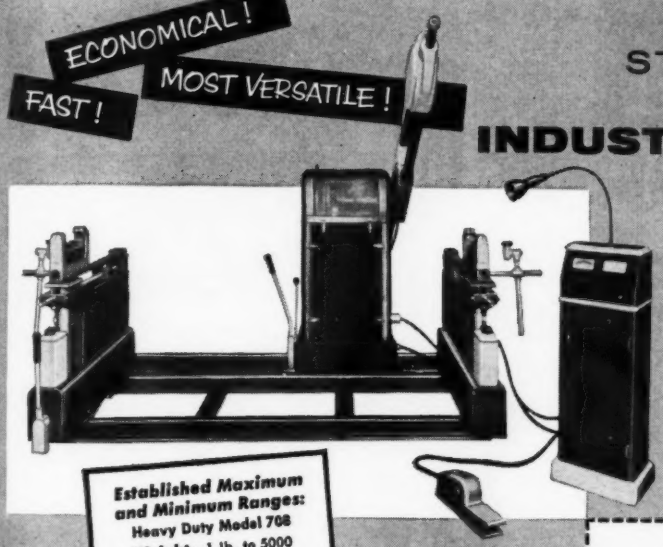
ECONOMICAL! FAST! MOST VERSATILE!

THE NEW STEWART-WARNER "ELECTRONIC" INDUSTRIAL BALANCER



Wide Range Use—Handle single-piece, short-run and long-run production, as well as maintenance of your own machines.

Fast set-up! Adjusted to handle any job in less than two minutes.

No special tools required! New design permits change-over from one job to another without special fixtures.

Easy to operate! Semi-skilled workers can learn in one day.

Precision sensitivity! Balances both kinetically and dynamically with maximum sensitivity.

Lowest Cost! Cuts cost of balancing *per piece* so low that even smallest shops can now afford their own precision balancer.

Established Maximum and Minimum Ranges:
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Weight—1 lb. to 5000
Diameter—1" to 68"
Length—7" to 83"
Sensitivity—0.04 inch-oz.
Portable and Standard Duty Models also available.

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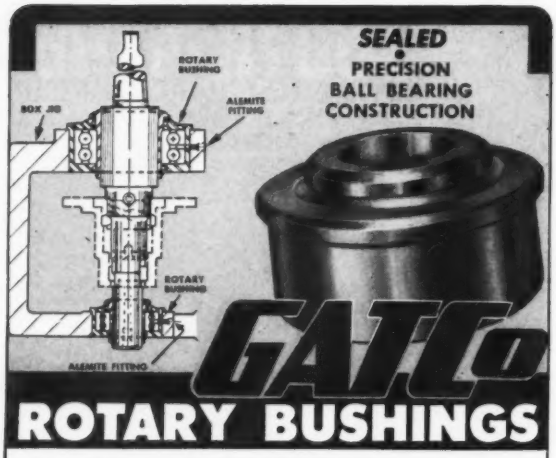

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ROTARY BUSHINGS

For DRILLING, CORE DRILLING, ROUGH and FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both.

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

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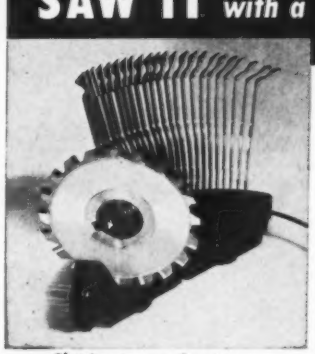
Telephone PLYMOUTH 1472

CIRCLE INFORM-A-GRAM KEY NO. 2321

If You Can See It — You Can
SAW IT *with a* GAY-LEE



Slotting typewriter type bar segment.

"THINSAW"

Solve problems in high-precision slitting, slotting, sawing with Gay-Lee carbide-tipped Thinsaw! Wafer-thin for the most delicate work with positive alignment and rigidity that avoid run-out . . . but retaining the speed and long life of carbide. Patented construction holds tips firmly.

- **THIN AS .030"**
- **DIAMETERS UP TO 12"**

Complete Line of Saws for Any Application—To Any Tolerance

WRITE FOR FULL INFORMATION

GAY-LEE COMPANY
CLAWSON • MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2322

Thermo-Cote

STRIPPABLE PROTECTIVE COATINGS

for

SUPERIOR STABILITY

Thermo-Cote strippable protective coatings maintain high stability in the melt tank, resisting darkening and breakdown in use. This economical feature minimizes costly material waste and allows maximum reuse of Thermo-Cote.

Light and crystal clear when applied it provides excellent transparency for inspection and legibility with complete protection against rust, abrasion and corrosion.

Write today for new free literature.

BISCHOFF CHEMICAL CORPORATION
115 MAIN STREET, IVORYTON, CONN.

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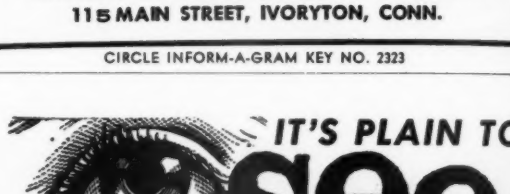
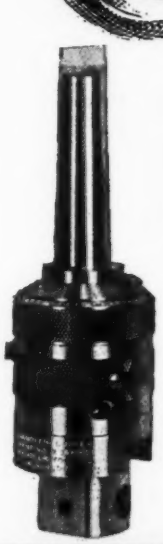




A Boring Head That Won't Face is NOT Complete

NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

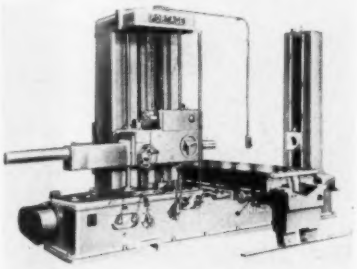
LOOK INTO THIS before you buy that new head. Write for full details.

CHANDLER TOOL CO.
Muncie, Indiana, U.S.A.

Chandler-Duplex
COMBINED BORING AND FACING TOOLHEADS

CIRCLE INFORM-A-GRAM KEY NO. 2324

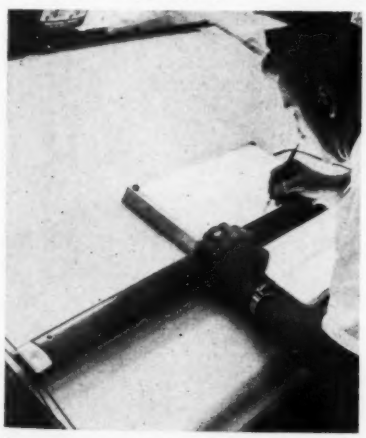
Vertical Head Travel of 48" and cross travel of table on the saddle of 60" are features of the 5" dia spindle, horizontal boring, drilling, and milling machine. The No. 5 has a table working surface of 36" x 72". There



are 34 available speeds which range from 7 to 1,000 rpm. Optional ranges and sizes include 36", 60", 72", vertical head travel and table working surfaces from 48" x 72" to 48" x 96". The Portage Machine Co., 1046 Sweitzer Ave., Akron 11, O., or —
Circle Inform-A-Gram No. A46.

A Complete Line of acrylic plastic drafting triangles of large sizes and improved precision have been announced by Dolgorukov Mfg. Co., Fisher Bldg., Detroit 2. These layout Triangles are light weight, transparent, and easy to manipulate. These triangles are available from stock in sizes up to 24" and larger sizes on special order.
Circle Inform-A-Gram No. A47.

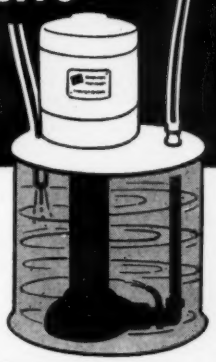
A Lightweight, Illuminated Portable Tracing Unit is offered by The Ozalid Div'n of General Aniline and Film Corp., 6 Corliss Lane, Johnson City, N. Y. Porta-Trace can be used for photographic work, opaquing, retouching, stripping-in, and viewing



transparencies. For use in the drafting room, Porta-Trace is thin enough to be slipped under a string type parallel rule on a standard size drafting board. It is available in surfaces ranging from 10" x 17¼" to 23¼" x 35¼" x 36¼".
Circle Inform-A-Gram No. A48.

Handi-Lube, liquid gear composition, is available in a pushbutton aerosol container for handy lubrication of open gears and sliding surfaces. A tough protective film of the composition is sprayed on pressure side of the surface from a distance of 12" to 18". This film of lubricant eliminates harmful metal to metal contact and increases gear life by putting the wear on the lubricant instead of the metal. The Whitmore Mfg. Co., Cleveland 4, or —
Circle Inform-A-Gram No. A49.

GRAYMILLS *Superflo*
PUMPS CIRCULATE
Carbide-Cutting Abrasive
Slurry Day In···Day Out
NO TROUBLE



YOU GET THE SAME ABRASIVE PROOF CONSTRUCTION WITH BALANCED FLOATING IMPELLER DESIGN WHEN YOU SPECIFY GRAYMILLS PUMPS FOR YOUR MACHINES

Thousands of Graymills Superflo Pumps are in continuous use, pumping abrasive slurries, ground glass, lens polishing rouge, enamels, lacquers and degreasing solvents.

They stand up because they're built for most tortuous applications. They resist wear and binding because the impeller floats on a cushion of liquid—no metal to metal contact, no seals, no packing.

Compared to such jobs as these, pumping coolants is a cinch. You can count on smooth, quiet performance—abundant volume—long life. They're DEPENDABLE!

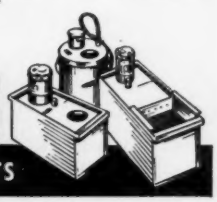
Sold by leading Industrial Distributors everywhere. Graymills representatives near you are ready to help with special problems.

Graymills Corporation, 3713 N. Lincoln Ave., Chicago 13, Ill. 142

WRITE FOR THIS NEW CATALOG

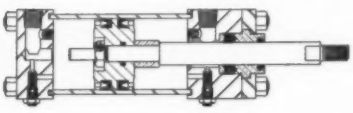
showing standard and JIC model centrifugal and gear type 1/25 to ¾ H.P. Pumps, Pumping Units, Accessories and helpful selection chart.

GRAYMILLS

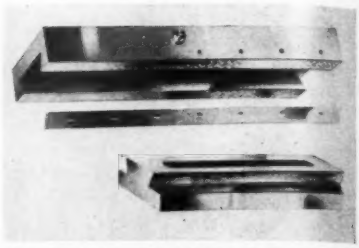


Superflo COOLANT PUMPS AND UNITS

200 PSI Operating Pressure is a feature of the Lynair cylinders. The U cup piston packing, chevron rod packing, and rod scraper are homogeneous synthetic rubber, and the piston is positively locked on the rod with nut and grub screw. The piston rod is high tensile, turned, ground, and polished shafting, hard chrome plated 0.001 on dia. The shell is cold drawn seamless steel tubing, hone to 15-20 micro-inches either cadmium or hard chrome plated. Lynair, Inc., 3100 Michigan Ave., Jackson, Mich., or—**Circle Inform-A-Gram No. A50.**

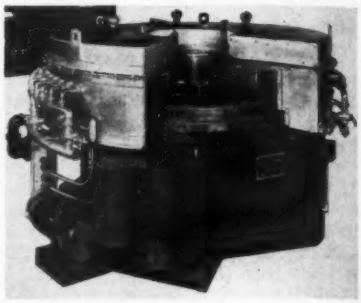


A Heavy Duty Slide is one of a line of precision slide assemblies which now includes 132 standard models. This line and other standard, stock components are for building up special machines and production equipment. The heavy duty slides (expanded view shown) provide maximum rigidity, permit longer overhand, and have a heavier section for mounting tools, fixtures, etc. Stroke lengths from 2" to 8" are available, with working surfaces from 4" x 8" to 8" x 24". Russell T. Gilman, Inc., 623 Beech St., Grafton, Wis., or —
Circle Inform-A-Gram No. A51.

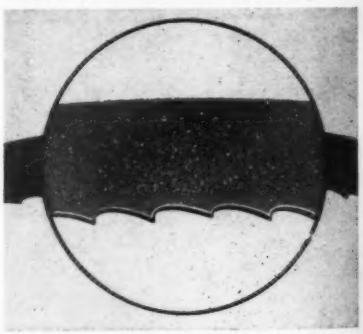


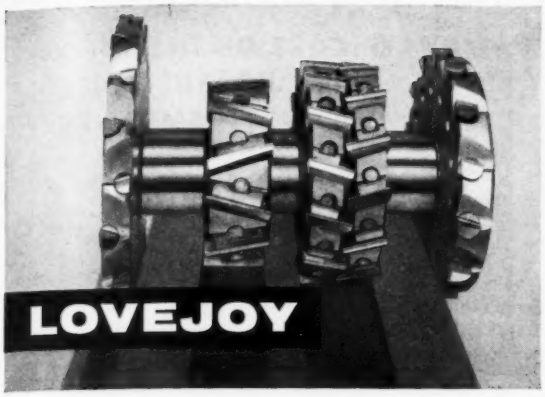
SHELDON U.S.A.
CHICAGO
Variable Speed
PRECISION LATHES
A new series of 11" and 13" Precision lathes with . . . toolroom accuracy . . . spindle speeds to 2,000 r.p.m. . . . instant and automatic selection of speeds . . . increased horsepower to spindle . . . and a full range of toolroom and production accessories for greater versatility.
SLOW
FAST
Write for This New Bulletin!
complete specifications . . . detailed explanation of new variable drive . . . information on many new production accessories.
SHELDON MACHINE CO., INC.
4235 N. Knox Ave., Chicago 41, Ill.
CIRCLE INFORM-A-GRAM KEY NO. 234

Especially Adaptable to the debonding and blueing of rotors used in electric motors is the G.A.S. rotor heating unit. It heats the periphery of the rotor to approximately 900° F, to separate the diecast aluminum from the steel laminations. Heating time is 3 to 4 min for a 4" dia rotor with production from 350 to 400 units/hr. Gas Appliance Service, Inc., 1940 Balmoral Ave., Chicago 40, or—**Circle Inform-A-Gram No. A52.**



Ability to Retain Hardness up to temperatures of 1100° F is a feature of the Safe-Flex band saw. It has extremely hard teeth for cutting maximum speeds and feeds combined with a back that has flexibility and extra toughness for safety and long life. The Safe-Flex high speed steel band saw will cut at rates up to 10 times faster, with cutting life up to 30 times greater than regular blades. Thicknesses range from 0.025" to 0.042". The L. S. Starrett Co., Athol, Mass., or —
Circle Inform-A-Gram No. A53.





Half side, plain and slotting cutters

Use Lovejoy inserted-tooth mills for maximum output, accuracy and fine finish — whether for narrow or wide straddle cuts, or shallow or deep slotting cuts. Exclusive body designs permit use of correct blades for each job and every material — with tooth spacing and blade capacity for all conditions.

The full line of Lovejoy half side milling, plain milling and slotting will be found in Catalog No. 32. Write for your free copy.

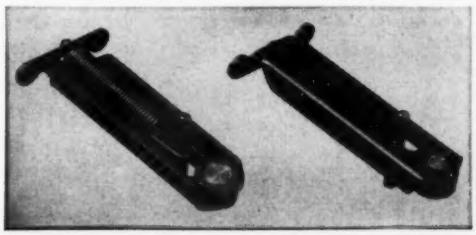
LOVEJOY TOOL COMPANY, INC.

146 Main Street, Springfield, Vermont, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 2351

FOR POSITIVE STOCK ALIGNMENT

IN PROGRESSIVE DIES



Amcor Roller Stock Pushers

SPEED UP PRODUCTION with precision-made AMCOR Roller Stock Pushers. Easy, smooth stock feeding, without buckling, assures more production with less operator fatigue.

SAVE MONEY. AMCOR Roller Stock Pushers sell for just a fraction of what hand-made bench models cost to make.

SIMPLE TO INSTALL. Requires only a slot milled in the stripper plate, and a hole drilled in the die block and stripper plate. Tracing template for slot and hole location is supplied. When die is sharpened, no refitting is necessary.

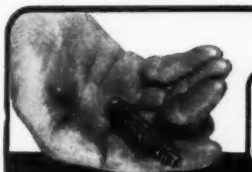
The AMCOR Roller Stock Pusher is quickly adaptable to any work specifications. Distributors throughout the country stock a complete line of nine models to fit all production needs.

Write us for complete information

APPLIED MECHANICS CORPORATION

528 Fourth Street N.W., Grand Rapids 4, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 2352



IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

You Need an Extra Hand Now to Speed Up Production!

HEIMANN TRANSFER SCREW SETS

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work *now*—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2353

PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

UNITED STATES DIAMOND WHEEL CO.

1833 ILLINOIS AVE. AURORA, ILL.

US

IMMEDIATE DELIVERY on all wheel sizes. STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

CIRCLE INFORM-A-GRAM KEY NO. 2354

Make 3 hammers AT ONCE!

It's the NEW, easy, economical, quick way to mold your own lead hammers on a production basis with "SHUR-GRIP" handles and this COOK production mold.

COMPLETE LEAD HAMMER SERVICE

Write for circular and prices

LAWRENCE H. COOK, INC.

68 MASSASOIT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 2355

Machine Surfaces and Profiles *WITHOUT RESETTING WORK*

with the **JEMCO H-20 tool room shaper**

Furnished complete with
Dividing head with tail stock
2 work holding fixtures
Swivel vise
Large work table with locking jaws

- Accommodates wide variety of precision work within a range of 8" x 11⅞"
- Accurate to within ±0.0005" within 6"
- Changes strokes by switch control to either 60 or 120/min.

EXCLUSIVE TERRITORIES OPEN

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Jersey manufacturing company

401-B LIVINGSTON ST. • ELIZABETH, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 2356

NOW

GET CLEAN SURFACED PARTS FROM YOUR AUTOMATICS ... UNMARRED BY TOOL WITHDRAWAL MARKS

THE NEW RELIEVOMATIC SELF-RELIEVING TOOL HOLDER

SAVES YOU COSTLY SECONDARY FINISHING OPERATIONS

Avoid scratches like this

All clear with "Relievomatic!"

Easily installed on cross-slide or turret

Write today for details.

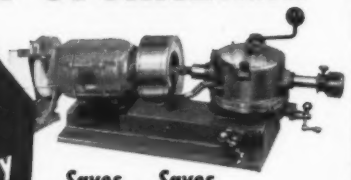
SILBER PRODUCTS, INC. WOrth 6-1133

134 Lafayette Street • New York 13, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2357

Super MULTI-SPIRAL END MILL GRINDING FIXTURE

SHARPENS END MILLS Quickly... Completely IN YOUR OWN SHOP



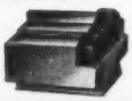
Saves Time • Saves Money

For grinding or milling of any spiral lead. Pays for itself in a hurry. Send for facts today.

SPIRAL SPECIAL CUTTING TOOLS

Cut Operations 75% or More!

Custom-designed, precision made, exactly to fit your needs. Boost both output and quality. Ask for details.



SPIRAL STEP TOOL COMPANY

Designers and Manufacturers of All Types of Special Cutting Tools

5400 N. Damen Ave. • Chicago 25, Ill.
Phone: LOngbeach 1-5384

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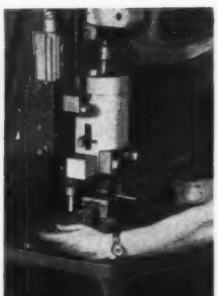
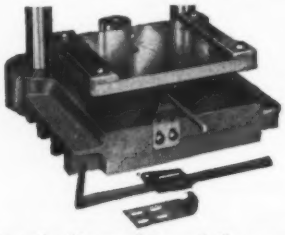
Adjustable Automatic Stock FEED STOP for DIES

Dahlstrom Light Duty **AUTOSTOP**





No drill jig...
No slotting...
No milling...

$1.75

Tested and improved through the years, the Dahlstrom Autostop will save hours of your high priced labor. Adjustable to work with blanking, progressive and compound dies. Mounts on stripper plate in 15 minutes. Handles sheet steel up to 1/16" x 6" or equivalent weight.

TO INSTALL: Just drill one 7/32-inch hole, then drill and tap four mounting holes per directions. That's all there is to it!

Trial order $1.75 each; lots of 12 $1.50 each. State whether for use on compound or progressive dies. *Write for free pamphlet.*

By the makers of the **DAHLSTROM TAP GUIDE**

Branch MANUFACTURING COMPANY

16 OLSON DRIVE • NORTH BRANCH, MINN.

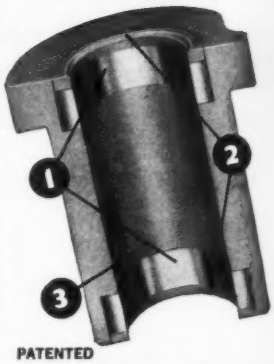
CIRCLE INFORM-A-GRAM KEY NO. 2362

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation !*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures... accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 41.



PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

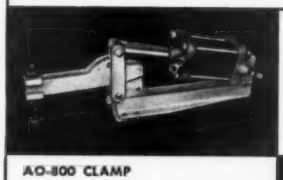
EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 2363

You asked for it...

KNU-VISE has come up with it!



TWO NEW AIR-OPERATED CLAMPS with 800 pound clamping force

AO-800 CLAMP

AODT-800
DOUBLE TOGGLE CLAMP

Because you asked for it, Lapeer's vast line of Knu-Vise clamps now features four distinct groups of air-operated clamps. Two new 800 lb. air clamps have been added to the widely accepted 200, 400 and 1200 lb. air clamps, thereby rounding out the Knu-Vise series. The Model AO-800 clamp is for conventional holding operations—the Model AODT-800 for those difficult mounting situations.

For complete information on these units and the more than 150 other models available, write for catalog today!

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS LAPEER MANUFACTURING CO.

3064 DAVISON ROAD • LAPEER, MICHIGAN

WESTERN DIV.: 422 Magnolia, Glendale, Calif. • CANADIAN DIV.: Higginson Equipt. Sales Ltd., Hamilton, Ont.

CIRCLE INFORM-A-GRAM KEY NO. 2364

A Line of Pinch Roll Belt Grinders is capable of providing outstanding surface finishes while grinding titanium, stainless steel, or carbon steel flat stock to precise gage thickness in a single pass. Four machine sizes are available, providing capacities of

36", 48", 60", and 72". The belt drive and idling mechanism provides for belt travel over four rolls designed in a diamond shape. This arrangement gives improved flexing and chip removal. Mattison Machine Works, Rockford, Ill., or —
Circle Inform-A-Gram No. A54.

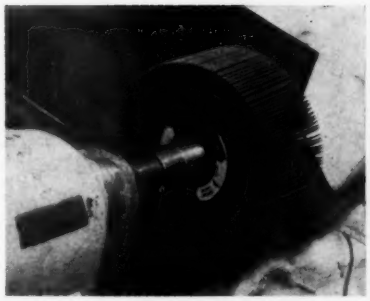
Small Toggle Clamps. Tiny-Toggles, are ¾" high and 2¾" long when closed but have a holding pressure up to 42 lbs. They can be used for holding small assemblies during multiple wiring, soldering, and sim-

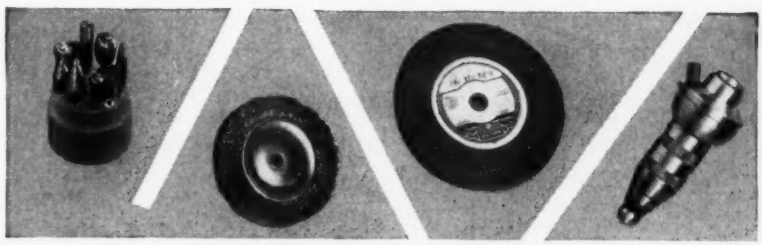
ilar operations. Available in 4 models, Tiny-Toggles have solid holding bars, and will solve many work holding problems where small clamps with relatively light holding pressures are needed. Detroit Stamping Co., 344 Midland Ave., Detroit 3, or —
Circle Inform-A-Gram No. A55.

High Speed Tool Steel, heat treated for maximum wear resistance, are the continuous pilot counterbores in sizes for U.S.S. cap screws No. 6 up to ⅝". Concentricity between the pilot and cutter body is

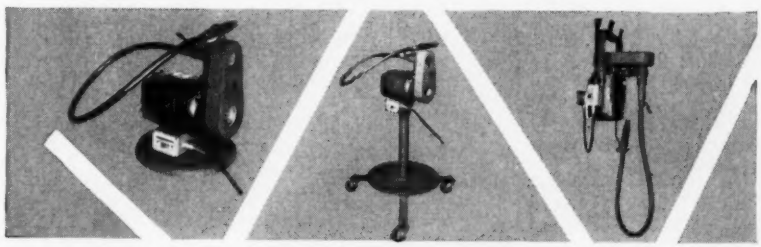
held extremely close by grinding the entire tool form on centers. As the tool wears, the cutter body may be re-sharpened many times and the pilot length may be cut off as required. Fastcut Tool Co., 7405 E. Davison, Detroit 12, or —
Circle Inform-A-Gram No. A56.

Disposable Flanges and a design that permits flush sanding are two major improvements in the line of small coated abrasive PG wheels for finishing and maintenance operations. Another feature of the wheels is that the flanges and cap nut are recessed onto the side of the wheel so it can be used flush against a surface. Specifications for the flanges include a standard 1" center hole on wheels 6" dia; and a standard 1¾" center hole on wheels with a 7", 8", 9", or 10" dia. Minnesota Mining and Mfg. Co., Dept. F7-268, 900 Bush St., St. Paul 6, Minn., or — **Circle Inform-A-Gram No. A57.**





everything you need



from start to finish

Remember, when you're checking specifications and selecting equipment, don't fail to consider Haskins flexible shaft machines and accessories. Haskins' complete line of equipment insures faultless performance on your *special* and *standard* metal-working operations —*without interruptions.*

Whether you're grinding, wire-brushing, filing, whatever the job, a start with Haskins will carry you through from the beginning right down to a perfect finish. Our three models, bench, pedestal and suspended mounts, plus a multiplicity of metal-working tools, enable you to achieve faster production, lower labor costs and a superior finished part! Find out about the versatile line of Haskins flexible shaft machines and accessories—*leaders in their field for over 30 years.*

Write Today for a Catalog and Literature

HASKINS

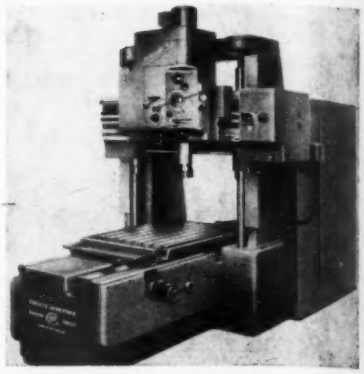
R. G. HASKINS Co.

605 S. Washtenaw Chicago 12, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 237

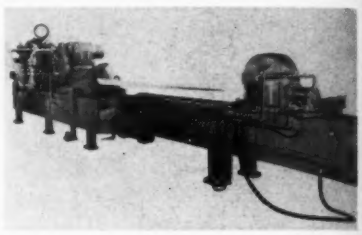
Heavy Duty Kendex throw-away insert tools are announced by Kennametal Inc., Latrobe, Pa. Large triangular carbide inserts (⅝" inscribed circle and ¼" thick) are used in three styles of holders. There are holders for heavy plunge cutting on tracer control or automatic lathes, for turning or facing to a square shoulder, and an offset tool for shaft turning or facing to a square shoulder. The inserts are available in either precision (all surfaces ground) or utility (ground top and bottom) types. **Circle Inform-A-Gram No. A58.**

A Jig Boring and Milling Machine is designed for drilling, boring, and milling a variety of parts requiring high standards of accuracy. Featuring an enclosed optical measuring system in English units of measure, the Hydroptic-6A is calibrated at a standard temperature of 68° F.



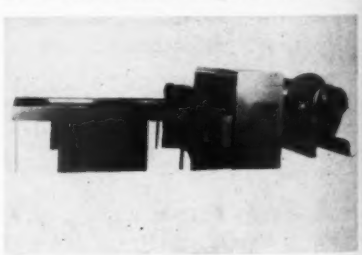
Specifications include 40" table travel, 28" spindle head travel, 12" spindle quill traverse, and can be ordered with the automatic repeating device. American SIP Corp., 100 E. 42nd St., New York, 17, or — **Circle Inform-A-Gram No. A59.**

A Range of High-Production Hydraulic stretching and detwisting machines for straightening both ferrous and non-ferrous metal sections has been developed. A feature of the new stretchers is their optional availability with a special open tailstock,



designed to allow the stock to protrude past the gripping jaws. Available in sizes up to 200 tons, they can handle extruded or rolled bars, tubes, structural shapes, or sheet and strip. Loma Machine Mfg. Co., Inc., 114 E. 32nd St., New York 16, or — **Circle Inform-A-Gram No. A60.**

Plantmaster, an automatic metal shear, decoils, straightens, shears, and stacks in one operation. It will cut metal up to 18 gauge in widths to 4'. Because of its improved method

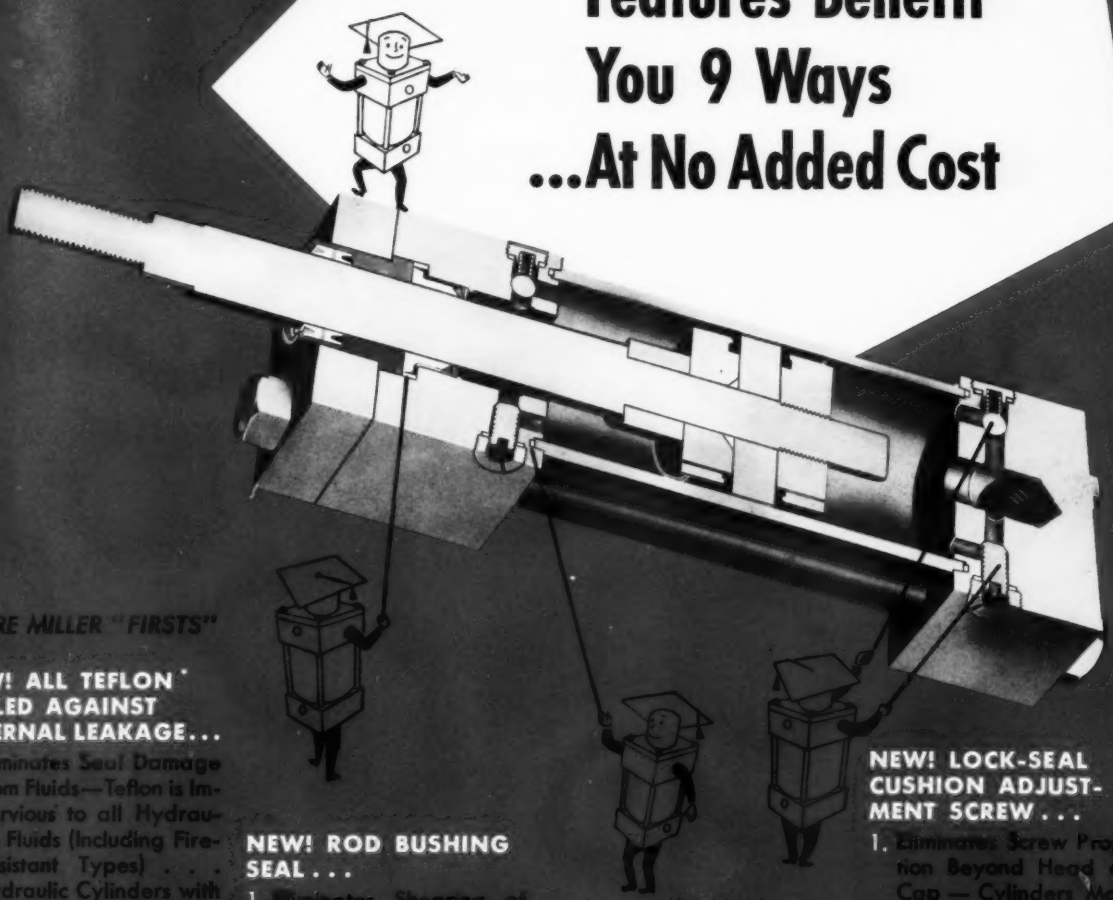


of feeding and straightening, it requires little floor space. The Plantmaster operates at high speed and with extreme accuracy. General Products Co., Fredericksburg, Va., or—**Circle Inform-A-Gram No. A61.**

WHAT...
NO UNIVERSAL
DRILL
BUSHINGS?
You'll get fast delivery—often within 24 hours—
on all standard sizes and lengths of drill bushings when
you order from Universal's big stocks in any of three warehouses
located at Frankenmuth, Michigan; Kenosha, Wisconsin;
and Newark, New Jersey. Even those orders for specially-made,
non-standard sizes are filled quickly, thanks to Universal's
large-volume production facilities. Machined from highest quality
steel, Universal bushings have super-finished bores which
lengthen tool life and reduce bushing wear. Wherever there are
holes to drill using jigs or fixtures, you'll find that it pays
to specify precision-made Universal drill bushings.
FREE UNIVERSAL SELECTOR.
Gives all engineering data for
selection of all types and sizes of
drill bushings up to 1¾" drill size.
Send request on your company
letterhead to receive one of these
helpful Universal Selectors.
UNIVERSAL ENGINEERING CO., FRANKENMUTH 8, MICHIGAN
205
CIRCLE INFORM-A-GRAM KEY NO. 238

Miller®

4 New Hydraulic Cylinder Features Benefit You 9 Ways ...At No Added Cost



MORE MILLER "FIRSTS"

NEW! ALL TEFLON* SEALED AGAINST EXTERNAL LEAKAGE...

1. Eliminates Seal Damage from Fluids—Teflon is Impervious to all Hydraulic Fluids (Including Fire-Resistant Types) . . . Hydraulic Cylinders with Teflon Piston Cups Slightly Higher.
2. Eliminates Seal Damage from High Temperatures —Teflon Sealed Cylinders Operate At —100° F. to 500° F.

NEW! ROD BUSHING SEAL . . .

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at Extreme Pressures.

NEW! SHEF SEAL AT TUBING ENDS . . .

1. Eliminates Shearing of "O" Ring in Re-Assembly
2. Eliminates Extrusion of "O" Ring at ANY Pressure—Teflon Sealing Ring is Backed Up by Zero Clearance Metal Shoulder.

NEW! LOCK-SEAL CUSHION ADJUSTMENT SCREW . . .

1. Eliminates Screw Projection Beyond Head and Cap — Cylinders Mount on Any Side.
2. Eliminates Manual Sealing and Locking After Flow Adjustment—Teflon Seal is Self Regulating and Self Locking.
3. Eliminates Accessibility Problems—Cushion Screw Interchangeable with Ball Check Position—Adjustable Through Small Wrench Hole Drilled in Interfering Machinery.

*du Pont trademark for its tetrafluoroethylene resin

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Turn Page For Cross Section Of SHEF SEAL

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal

OTHER MILLER QUALITY FEATURES

- Case-Hardened Chrome Plated Piston Rod
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers
- Interchangeable Square Design

Miller - FLUID POWER DIVISION

2046 N. Hawthorne Ave., Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS • COUNTERBALANCE CYLINDERS • BOOSTERS

Miller®

Announces a New Space and Price Saving Hydraulic Cylinder Line

MORE MILLER "FIRSTS"

SAVE UP TO 76% OF COST

Heavy Duty Model LH—Same Size As Ordinary Gasket Type Square Design Low Pressure Cylinders			
BORE	NORMAL RATINGS	NON-SHOCK INTERMITTENT RATINGS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

Miller®

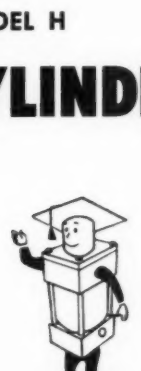
Announces 50% More Power Per Cylinder Dollar

with Extra Heavy Duty

3000-5000 PSI MODEL H

HYDRAULIC CYLINDERS

Same Price and Mounting Dimensions as Miller 2000-3000 PSI Hydraulic Cylinders.



BOTH LINES MADE POSSIBLE BY SHEF SEAL

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Miller - FLUID POWER DIVISION
FLICK-REEDY CORPORATION

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

OTHER MILLER QUALITY FEATURES

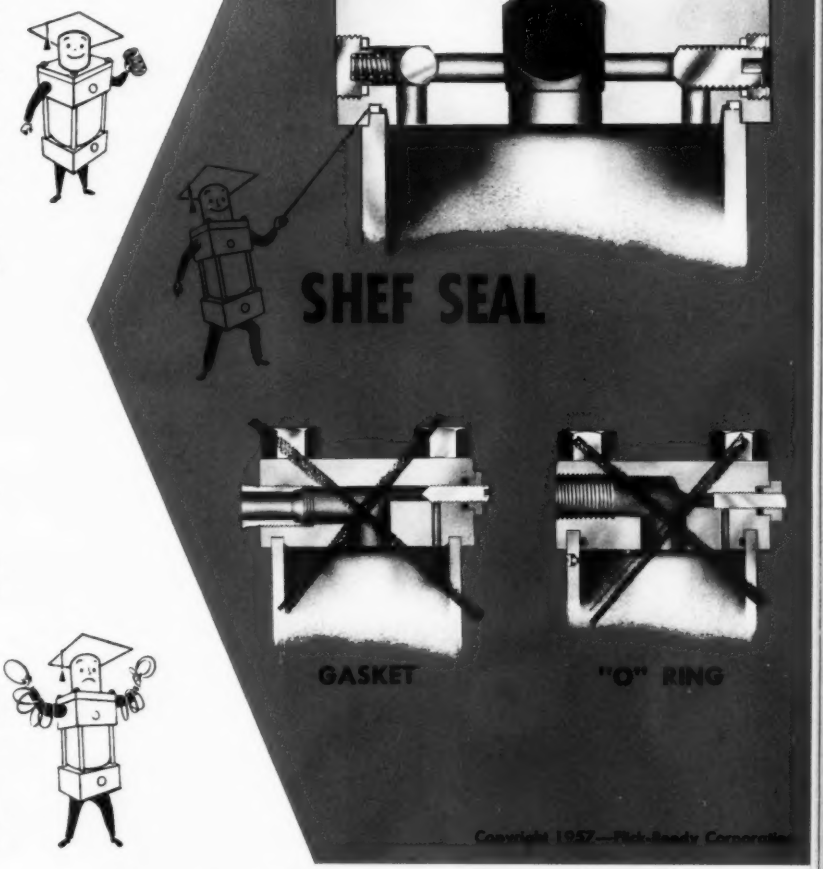
- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal

SHEF SEAL Obsoletes All Other Hydraulic Cylinder End Seals . . . *at no added cost*

HAS EVERY ADVANTAGE

1. Pressure Energized—Sealing Effectiveness Increased with Pressure.
2. Zero Metal-To-Metal Clearance at all Pressures Gives You Perfect Seal Backup. Sealing Ring Cannot Extrude.
3. Simplified Servicing. No "Blind" Assembly. Sealing Ring Cannot Shear.
4. Teflon* Sealing Ring Withstands All Hydraulic Fluids at Temperatures from —100° F. to 500° F.
5. Head and Cap Axial Movement Does Not Destroy Sealing.
6. Allows Air Bleed In Head and Cap for Remote or Automatic Bleeding.
7. One Sealing Ring Cross Section Dimension For All Cylinder Sizes—Supplied On Convenient Spools.
8. Zero Metal Backup Clearance Eliminates Dangerous Leaks and Spurts of Fluid Due To Seal Failure.



NONE OF THESE DISADVANTAGES

GASKET CONSTRUCTION

1. Unpredictable Results—Leaks and Blows Even at Low Pressures.
2. Outlawed by J.I.C. Eight Years Ago.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.

"O" RING CONSTRUCTION

1. High Pressures and Shock Loads Expand Tubing—Increase Clearance and Cause Extrusion.
2. Blind Assembly Can Shear Sealing Ring—Difficult Servicing.
3. Seal Failure Causes Dangerous Leaks and Spurts of Fluid. Creates Unnecessary Fire and Safety Hazard.
4. Requires Large Inventory of "O" Rings
   —For Servicing Variety of Cylinder Bores.
   —For Special Synthetic Rubber Compounds To Meet Ever Changing Fluid and Temperature Needs.

*du Pont trademark for its tetrafluoroethylene resin.

SHEF SEAL—*Another Miller "First"*

When you buy Miller ... You buy extra years of worry-free Cylinder performance ...at competitive prices

S SHEAR PROOF
H HEAT PROOF
E EXTRUSION PROOF
F FLUID PROOF
SEAL
Teflon Pressure Energized
Hydraulic Cylinder Tubing End Seal

OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

Miller FLUID POWER DIVISION

Turn Page For More About MILLER

AIR AND HYDRAULIC CYLINDERS ... ACCUMULATORS ... COUNTERBALANCE CYLINDERS ... BOOSTERS

All Teflon Sealed —Perfect Sealing for Hydraulic Cylinders

HAS EVERY ADVANTAGE...

Teflon—As Static and Dynamic Seals

1. Impervious to Every Hydraulic Fluid Including Fire-Resistant Types.
2. Seals Perfectly in Cylinders at Temperatures from —100° F. to 500° F.
3. Can Be Molded Into Shapes That Have Zero Leakage—Hold Pressure Indefinitely.
4. With Proper Design of External Seal Cavities, Teflon Can Be Included *Without* Increasing Prices. Miller Provides Teflon for all External Seals at Prices Competitive with Ordinary Cylinders. Leather Internal Piston Cups are Standard (Teflon Cups Extra).

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Printed in U.S.A.

•du Pont trademark for its tetrafluoroethylene resin.

When you buy Miller
You buy extra years
of worry-free
Cylinder performance
...at competitive prices

NONE OF THESE DISADVANTAGES

Synthetic Rubber— As Static and Dynamic Seals

1. Unsatisfactory Except When Used With A Limited Range of Hydraulic Fluids.
2. Even Uncontrollable Changes in Fluid Additives Often Destroy Seal.
3. Specific Compounds Needed for Compatibility with Specific Fluids Normally Used Today.
4. Normal Temperature Range Limited to 0° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Greatly Reduced Life at 150° F. to 250° F.
5. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.
6. "U" Type Seals Without Mechanical Retainer at Mid-Section Frequently "Roll" and Lose All Sealing Ability.

Resin Impregnated Leather— As Dynamic Seals Only

1. Is Compatible with Many—But Not All—Hydraulic Fluids and Additives Including a few Fire-Resistant Types.
2. Normal Temperature Range Limited to —60° F. to 130° F. Slightly Reduced Life When Operated at 130° F. to 150° F. Substantially Reduced Life at 150° F. to 250° F.
3. External Leakage Causes Fire and Safety Hazards When Temperature or Fluid Destroys Seals.

Miller Uses Leather Piston Cup Seals for Internal Sealing... Standard Price (Teflon Cups Extra).

Piston Rings— As Dynamic Internal Seals

1. Most Piston Rings Allow Some Leakage.
2. Allow "Slip" or "Drift" of Piston Due To Leakage—Unsatisfactory for Many Applications.
3. Allow Varying Feed Rates Due To Leakage Because Of Viscosity Change During Startup—Unsatisfactory for Most Multiple and Automated Operations.
4. Allow Some Pressure Loss.
5. Chips and Dirt Enter Space Between Piston and Tube Causing Scoring —Especially During Startup.

All Teflon Sealed—*Another Miller "First"*

Miller FLUID POWER DIVISION
PITCH-REEDY CORPORATION

2046 N. Hawthorne Ave., Melrose Park, Ill.

AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

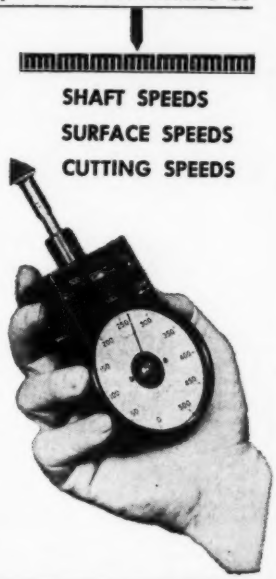
OTHER MILLER QUALITY FEATURES

- All Teflon Sealed Against External Leakage—Teflon Cups Extra
- Case-Hardened Chrome Plated Piston Rod
- Shear Proof Rod Bushing Seal
- Ball Check Interchangeable with Self Sealing and Locking Cushion Adjustment
- Rust Resistant Surfaces
- Teflon Oil and Dirt Wipers

SMITHS TACHOMETERS

For Precise and Rapid Measurements of

- **Magnetic Design** Steady readings accurate to ±0.5% at any part of any scale.
- **Instantaneous Reading** No timing or waiting.
- **Self-Powered** Needs no battery. Always ready for immediate use at full accuracy.
- **Nine Ranges** To 50,000 rpm on highest. Interpolate tenths of rpm on lowest.
- **Overspeed Protection** Inherent and built-in.
- **Hold Button** "memorizes" reading when desired.



Complete Service Facilities *Send for Details and Literature*

CLARENCE J. MARX CO.

Box 4033, Cleveland 23, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2411

Gage Company **PRECISION PLASTIC**

COMPARATOR SCALES

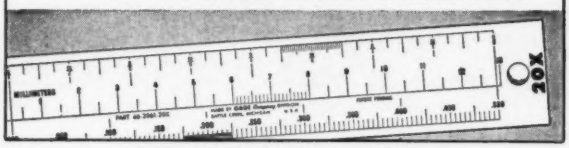
Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY

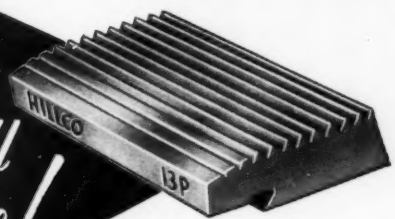
BATTLE CREEK, MICHIGAN



CIRCLE INFORM-A-GRAM KEY NO. 2413

"HILLCO" TANGENT CHASERS

We think you'll agree!



The new line of "HILLCO" Tangent Chasers, which can be re-ground for 80% of their original length, are guaranteed to be of highest grade tool steels ground to exacting tolerances. We feel that this complete line of chasers are the finest that we have produced in our 75 years of cutting tool manufacture. We think that you will agree with us.

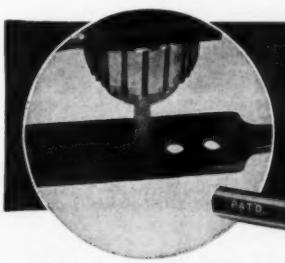
THE HILL ACME COMPANY

ACME MACHINERY DIVISION

1203 West 65th Street • Cleveland 2, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2412

Drill Hardened Steels without Annealing—



With the new, improved "HARDSTEEL" Drill, you can do accurate, smooth drilling, countersinking, counterboring and reaming in steels hardened by any process without first annealing the work. And they work with equal ease on work-hardening steels and high carbon—high chrome steels of any degree of hardness.

"HARDSTEEL" Drills fit standard drill presses. They save time and reduce rejects. They permit engineering changes requiring additional drilling after hardening. And parts drilled after hardening always match at assembly.

Write for a copy of the "HARDSTEEL" Operators Manual showing how "HARDSTEEL" drills are cutting costs in thousands of plants.

You Harden It—We'll Drill It—
With "HARDSTEEL"

BLACK DRILL COMPANY, INC.

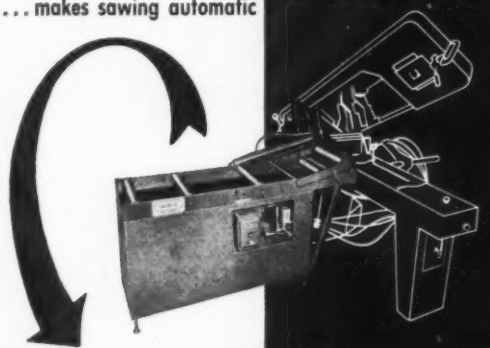
1368 East 222nd St. • Cleveland 17, Ohio

"HARDSTEEL"

CIRCLE INFORM-A-GRAM KEY NO. 2414

The KALAMATIC ... makes sawing automatic

AUTOMATIC BAR-FEED ATTACHMENT



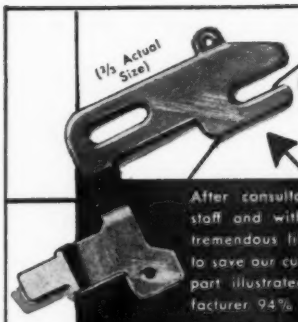
Featuring:

- Quick easy installation and adjustment.
- Accurate repetitive cutting with no intricate electrical equipment to go out of balance.
- Completely enclosed oil tank and ball bearing table rollers.

The Kalamatic automatically feeds rounds, flats, hex, pipe, tubing to most Kalamazoo metal cutting band saws—any length from 3/16" to 30". Thoroughly automatic, The Kalamatic helps prolong the blade life of the saw.

Machine Tool Division
Kalamazoo
TANK and SILO CO.
508 HARRISON ST.
KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2421



After consultation with our engineering staff and with the use of dies from our tremendous library maintained specifically to save our customers time and money, this part illustrated actually saved one manufacturer 94% of usual production costs!

Price breakdown was as follows:

Tools	$89.00
Labor	.072
Material	.011

LOW die cost
FAST delivery

- Blanking
- Forming
- Piercing
- Drawing
- Extruding
- Stenciling
- Tapping
- Countersinking
- Plating
- Machining
- Painting
- Grinding
- Welding

Yes, WLS SPEEDTOOLING for small quantity stamping needs is a saver every time! A radical production advancement, it eliminates most of the cost required for permanent dies. Finished parts are produced to tolerances as close as those from tools costing ten times as much. When jobs are completed WLS SPEEDTOOLING is stored for future use.

Use WLS for production quantities up to 100,000 when low cost, fast delivery, possible design changes for virtually nothing, are important factors!

FREE

1. Write now for a free sample part with a cost summary.
2. Our free bulletin also illustrates 40 small stampings.
3. Send in your blueprints to our engineering department for a prompt quotation.

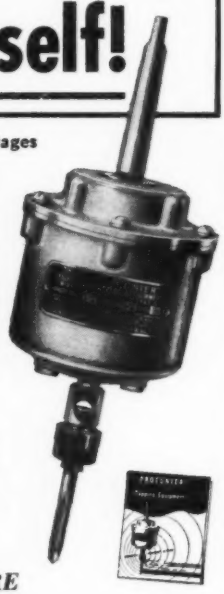
WLS STAMPING COMPANY
3283 E. 80th Street • Cleveland 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 2423

a PROCUNIER TAPPER
pays for itself!

Built-in features and operating advantages increase production—reduce costs!

Any way you look at it—you save and gain with Procunier Tappers. Countless reports indicate tremendous savings on taps, automatic production increases, drastic reduction in parts spoilage, less operator fatigue, fewer "down hours" and precision accuracy in threads and tapped holes. Taking these gains and savings into consideration you can quickly see why Procunier heads "pay for themselves in just a short time!"



Procunier heads offer high speed, quiet operation, a new, powerful drive —with finger tip pressure; economical lightness, "long life" ruggedness and an accuracy and dependability you can consistently count upon! And, there's a versatile model for practically every tapping operation.

SEND FOR FREE BROCHURE

Find out how you can benefit with Procunier. Get the full construction details — the "inside story" on why Procunier has led the field for more than 30 years.

PROCUNIER SAFETY CHUCK CO.
12-14 S. Clinton St., Dept. 10 Chicago 6, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2422

Typical method used in gear matching, showing flow of energy from meshing gears to probe.

GEAR MAKERS!
NOW SEE THE SOUND OF RUNNING GEARS ON A LARGE METER

On Gear Speeder tests, Sperry Bearing Tester provides direct *meter reading* of sound level. Simple to use, easy to mount directly on machine.

With SPERRY BEARING TESTER, *you can:*
Cut inspection costs • Insure uniform quality • Increase inspection rate
Exclude airborne noises • Eliminate human error

Lightweight, easily portable, the Sperry Bearing Tester is a versatile tool for use in preventive maintenance to pin-point machine wear, as well as on the production line to assure precision fit of mating parts.

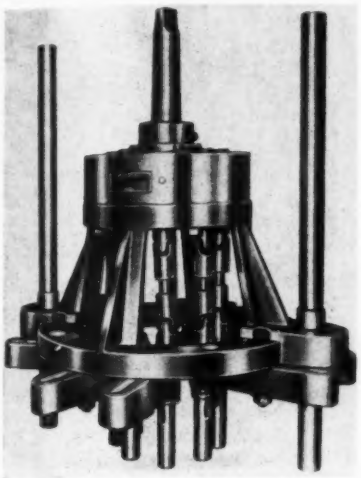
Write for Information.

400 Shelter Rock Road, Danbury, Connecticut

sperry products INC.
FIRST IN INSPECTION AND CONTROL

CIRCLE INFORM-A-GRAM KEY NO. 2424

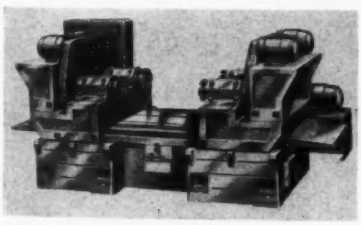
A Universal Joint Drilling Head allows a maximum drilling pattern of 14" without extension spindles. It is available up to 3 Morse taper sockets and with up to 12 spindles.



Heads with a greater number of spindles and a larger diameter capacities are available on special order. Errington Mechanical Laboratory Inc., Staten Island 4, N. Y., or —
Circle Inform-A-Gram No. A62.

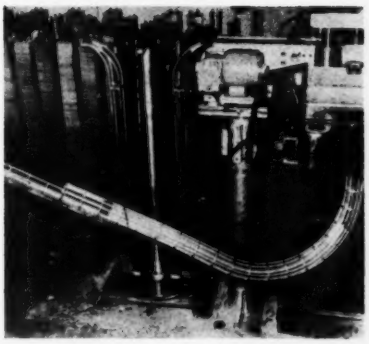
An Adhesive for bonding cured natural or synthetic rubber to metal is the Ray-Bond R-86001. Cured in 24 hrs at room temperature, it reaches maximum strength after seven days. To reach maximum strength immediately, it may be cured in 4 hrs at 120-140° F. It may also be used to bond metal or glass to metal, and as a protective coating, sealing, and casting compound. Adhesives Dept., Raybestos-Manhattan, Inc., Bridgeport 2, Conn., or —
Circle Inform-A-Gram No. A63.

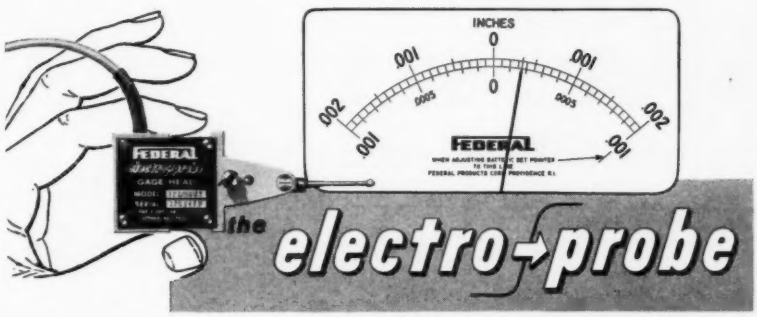
Two Standard Precision Boring Machines have been introduced by Ex-Cello-O Corp., 1200 Oakman Blvd., Detroit 32. One is a double-end machine and the other is single-end. Both are designed for single or combination operations of precision boring, turning, facing, grooving, and chamfering. The double-



end model, style 2440, has two bridges that support the spindles and either drive equipment. The maximum length of the stroke of the table is 40" and table fixture pad dimensions are 28" by 46".
Circle Inform-A-Gram No. A64.

Carry and Stack Stampings up to 20' away from the presses with a line of stacking chutes. Stampings that are springy, small, thin, delicate, or complicated are automatically transported from the presses to packaging or assembly lines without fear of damage to the product or to the dies. The chutes are mounted onto the die shoe of the press bolster and are adaptable to all types of OBI presses, high production presses, and dieing machines. Clark Industries, Delaware, O., or —
Circle Inform-A-Gram No. A65.





NEW, LOWER COST ELECTRONIC GAGING

The new Electro-Probe Model 230 P-2 is far more than just another electronic test indicator.

- **No need for special stands or holding fixtures.**
- **No need for external power.**
- **No voltage fluctuation or warm-up problems.**
- **No need for close gage head positioning during set-up.**

The Electro-Probe introduces a new concept in Dimensional Control.

Packaged for convenience

Electro-Probe gage head, self-powered amplifier and accessories, all in one lightweight case . . . easily carried from job to job.

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The Electro-Probe principle has exciting advantages in other fields of gaging. Ask us.

Ask **FEDERAL** *First*
FOR RECOMMENDATIONS IN MODERN GAGES . . .

1) **Take it anywhere.** Model 230 P-2 is completely portable and self-contained. It consists of a bantam size electronic gage head and transistor amplifier which, with metal carrying case and accessories, weighs only 8½ lbs. It is completely independent of external power, and electrical parts are hermetically sealed.

2) **Mount it on any conventional fixture.** No special stand or holding fixture is required because gaging pressure is extremely light (less than 5 grams). Supports which would deflect under even normally light gaging pressures remain rigid when the Electro-Probe is used. And the gaging pressure remains constant throughout range (change is less than 0.1 gram per .001").

3) **Set it up in a jiffy.** Now you have Precision *without* time-consuming, finicky adjustments. Master it anywhere within its range because response is absolutely linear. Full scale Zero Adjustment makes positioning easy and fast. Warm up time is virtually zero. Gage when *you're* ready!

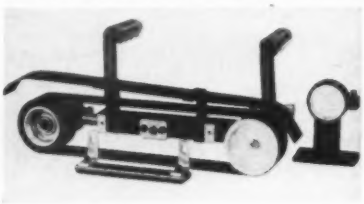
4) **Gage with ease and assurance.** Contact has friction-free travel of .060". Clutch mounting allows head to be placed in almost any position and provides complete over-travel protection. Either of two magnifications instantly available. Wide 4½" dial easy to read.

5) **Enjoy greater reliability than ever before.** Use of *Printed circuits* and *transistors* means trouble-free performance. Connections are sure, operating current amazingly low — no heating or voltage regulation problems, no dependence on electrical outlets. Learn more about this truly portable, reliable, accurate and versatile gaging device.

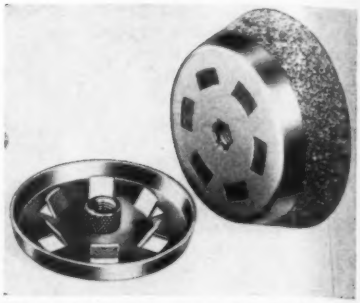
Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

CIRCLE INFORM-A-GRAM KEY NO. 243

Fast Operation with reduced operator fatigue is offered with the model 2-42 abrasive belt grinder. Designed for portable or fixed bench mounting, the unit will handle any grade grit of aluminum oxide or silicone carbide abrasive in 2" wide belts. Used as a portable hand unit, the flexibility of the belt permits grinding of convex or flat surfaces. Six different handle adjustment combinations can be made. Abrasive Machinery Corp., Dept 299, 444 S. Pennsylvania St., Indianapolis 4, or **Circle Inform-A-Gram No. A66.**

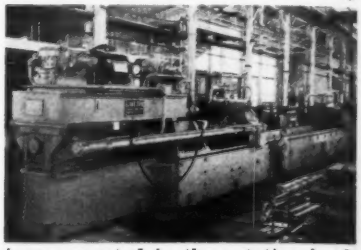


Increased Safety in the use of angle portable grinders is possible through the use of the safety guard insert. It eliminates the need of reinforcing rings, pronged anchor bushings, and individual mounting nuts.



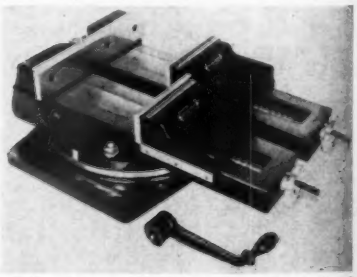
The grinding compound is locked in at three points, and is surrounded on the upper outside diameter so it does not take away any grinding surface in the life of the wheel. Carroll Pressed Metal, Inc., Worcester, Mass., or—**Circle Inform-A-Gram No. A67.**

A 300-Ton Hydraulic Stretcher straightens and detwists extrusions. It is 91' long and the stretcher will accommodate extrusions from 5' to 50' long. Centering can be done quickly and easily with four-way



jaws mounted in the rotating headstock. One cylinder actuates two vertical jaws simultaneously while separate cylinders operate two side jaws independently. Lake Erie Machinery Corp., 706 Woodward Ave., Buffalo, N. Y., or —
Circle Inform-A-Gram No. A68.

A Compact Differential Feed Mechanism is featured on all Hylo precision machine vises. This permits an increase in gripping torque without sacrificing speed of traverse. In the 6", 8", and 12" models the open-jaw capacity is equal to the width

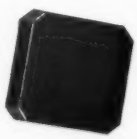


of the jaws. Utilizing two threads of different pitch on the same shaft, a single revolution of the drop-forged handle will open or close the hardened jaws at the high speed traverse rate of ½" per revolution. Redbow Precision Tool Co., 1113 W. Lawn Ave., Racine, Wis., or —
Circle Inform-A-Gram No. A69.

New McCROSKY Series "900" Milling Cutters

for Milling with "THROW-AWAY" Carbide Inserts

Standard 12" No. 967-T Face Mill Fitted with Triangular Carbide Inserts



Square Carbide Insert

Triangular Carbide Insert

These new cutters eliminate the time and cost of regrinding blades. They reduce the investment in cutters needed to handle a wide variety of work;—cut milling costs;—and provide users with all the other time and cost saving advantages of milling with "Throw-Away" carbide inserts.

Our widely used, patented Super-Jack* Wedges hold the inserts solidly against ground surfaces in the body, preventing any movement even under heavy feeds and speeds, assuring utmost efficiency and dependability. Inserts can be unlocked easily, and indexed quickly and accurately on the machine, providing almost uninterrupted production. Interchangeable with conventional cutters. 16 standard sizes including face and end mills. 4" to 12" diameter. Also "Specials" to meet any requirement. Get full details. Write for our new Bulletin No. 572—Today!

*U. S. Patents 2,508,437; 2,547,789; 2,632, 536

The complete McCrosky line includes:

Jack-Lock® Milling Cutters — *Wizard*® Quick-Change Chucks
Super® Adjustable Reamers — *Block Type* Boring Bars
Turret Tool Posts — *Specially Engineered* Multiple Operation Tools

Fully descriptive catalogs sent promptly on request. Write for yours today!

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ETALON INGAGE

measures the exact BORE or blind hole size!

Reading: .0001"

Size: 3/16" to 4"

Takes accurate measurements of blind holes. No masters or setting rings—measures directly—by .0001".

Automatic alignment, rectangular contact points guarantee extreme accuracy even when fully extended. Immediately detects out of round holes; with extensions measures holes up to 6 feet deep. Hardened contact points exert minimum pressure—will not damage fragile work.

Easy to read, deep graduations on a large diameter thimble. Dull chrome plated. Furnished in English or Metric graduations, individually or in sets.

WRITE FOR CATALOG on complete line of precision measuring instruments: VERNIER CALIPERS, MICROMETERS, DIAL INDICATORS.

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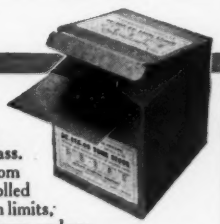
ARBOR SPACERS SHIMS and SPACING COLLARS • Arbor Spacers and Shims in 20 sizes and thicknesses from .001" to .125". Arbor Spacers furnished with standard keyway; Shims, with no keyway. Also Spacing Collars in numerous popular diameters, and in thicknesses from 1/8" to 3". Hardened and ground; edges chamfered. Furnished with standard keyway.

FEELER STOCK • Made from tempered stock, rolled to close tolerances, 1/2" x 25' coils packaged in transparent plastic boxes, except above .020". Strips 1/2" x 12", in cellophane. 27 thicknesses. All thicknesses from .001" to .032". (For use in precision fitting, checking clearances, inspection and production work.)



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CUT TOOLING COSTS WITH

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TEMPLATE DRILL BUSHINGS

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FOR 1/16" OR 1/8" SHEET STEEL OR ALUMINUM

SECURELY INSTALLED WITH ONLY A FLARING TOOL AND ONE IMPACT OF A HAMMER!

NO SKILL REQUIRED

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143 Netherwood Drive, Springfield, Penna.

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Here's a SWIVEL MACHINE VISE that will make PRODUCTION PROFITS for You

On such jobs as milling, drilling, grinding, shaping and other machine operations that require a rugged holding device. These famous heavy duty vises are precision built, can be used with or without the 360° swivel base, come in 2 jaw sizes, and speed up production wherever they're used.

NO. 40 . . . 4" jaw, without base, **$69.95**
with swivel base, No. 40B, **$79.95**

NO. 60 . . . 6" jaw, without base, **$89.95**
with swivel base, No. 60B, **$99.95**

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USED IN ALL INDUSTRIES . . . EVERYWHERE

There are 64 different models and types of Palmgren vises, rotary tables, milling attachments and other machine tool accessories, comprising the most complete line available anywhere, with jaw sizes from 1½" to 8".

Ask for FREE CATALOG No. 205, complete with full details and prices

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CIRCLE INFORM-A-GRAM KEY NO. 2462

Now! feed parts automatically with

Feedall

ELEVATING FEEDERS — For fully automatic feed and orientation of rolling or sliding parts.

HOPPER FEEDERS — For high production with minimum handling.

BAR FEEDERS — For continuous feed 5 to 20 fpm. Completely self-contained units with variable speed.

TO CUT COSTS: ADD COMPLETE AUTOMATIC FEED ON FAST PRODUCTION MACHINES

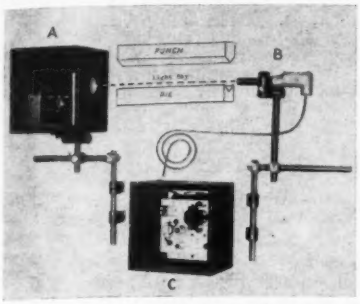
Feedall Automatics have now been used with exceptional results to feed gear blanks, valve plugs, steel or plastic bushings, bars up to 1-1/2" x 30" long, and scores of widely varied parts. These time and cost-saving machines add storage capacity, save manpower, boost production, cut unit costs. And engineering design is outstanding.

NEW CATALOG contains all data, includes estimate sheet. Write for your copy today.

Feedall *Producers of automatic feeding devices*
FEEDALL, INC. • WILLOUGHBY, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 2463

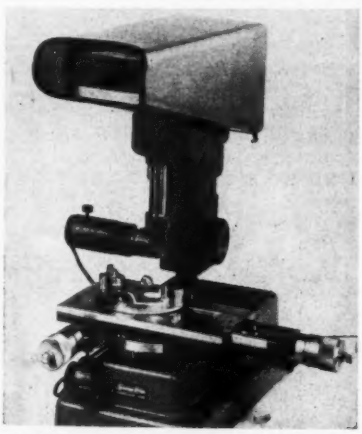
Guard Metal Cutting Shears and press brakes with photo-electric equipment with suitable solenoid locking devices or by the use of air cylinders to pull the clutch rod. This



electronic control for punch presses can be attached to stopping devices in several ways, and stops operations immediately. Searjeant Metal Products, Inc., Box 37, Mendon, N. Y., or **Circle Inform-A-Gram No. A70.**

Rubberized Abrasive Blocks do a quick and thorough job of removing smear metal and clogging in diamond wheels. The Cratex block flows around and between the diamond particles and cleans away the smear metal and clogging because of its cushioned action. Rubberized abrasives do not tend to knock the diamond particles loose from their metal bond as dressing blocks and other wheel dressers do. Cratex Mfg. Co., 81 Natoma St., San Francisco 5, or — **Circle Inform-A-Gram No. A71.**

A Toolmaker's Projector featuring extreme versatility and extended capacity is portable and ruggedly built for accuracy and stability under shop conditions. It may be used for circular form and single point tools; drill, tap, reamer inspections; screw

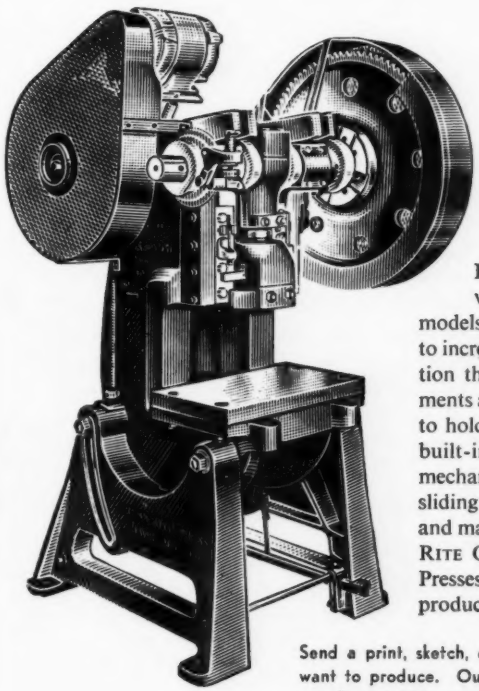


machine parts; gap setting and other micro adjustments. Reflections are sharp because images are shielded from light with an opaque photometric white 6" x 6" sq screen situated at the rear of the instrument hood. Stocker and Yale, Inc., Marblehead, Mass., or — **Circle Inform-A-Gram No. A72.**

Unusual Extra-Long Life and low maintenance are features of an air-powered reversible impact wrench, with ⅜" heavy-duty capacity. The impact mechanism allows smoother flow of power and longer life. In normal operating cycle, the threaded fastener will spin freely and the wrench will begin impacting only when torque resistance is built up. The impact wrench has a reversing button, built-in automatic oiler, and handfit pistol grip. The Aro Equipment Corp., Bryan, O., or — **Circle Inform-A-Gram No. A73.**

PRESS-RITE
O. B. I.
POWER PRESSES

2 TON
TO
85 TON



No. 3½—37 Ton Backgeared Press illustrated includes PRESS-RITE features that increase production and die life, cut maintenance costs.

High tensile, semi-steel frames, with built-in tie rods on larger models, hold deflection to a minimum to increase die life. Precision construction throughout with simple adjustments at wearing points makes it easy to hold accuracy. Greater die space, built-in non-repeat single stroke mechanism, automatic brake, 4 point sliding key clutch, efficient lubrication and many other features make PRESS-RITE Open Back Inclinable Power Presses high production presses that produce More Profits.

Send a print, sketch, description or sample of part you want to produce. Our engineering department will tell you the capacity press they recommend for the operation.

Ask your PRESS-RITE dealer or write for latest catalogue.

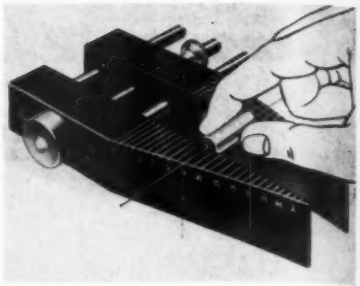
PRESS-RITE Division of
SALES SERVICE
MACHINE TOOL CO.
2351 University Avenue
ST. PAUL W-14, MINNESOTA

PRESS-RITE
O. B. I.
POWER PRESSES

CIRCLE INFORM-A-GRAM KEY NO. 247

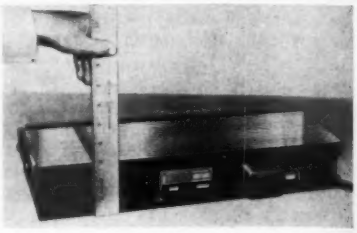
Automatic Transfer of cylindrical work between centerless grinding machines is possible with thru-feed conveyor. This unit features long-lift, positive drive chain belt with ratchet-type adjustment, and is capable of handling ¼" to 3½" dia work at preset speeds. While conveyors can be manufactured to any specified length, the recommended lengths are 52½" for 20" grinders and 63½" for 24" grinders. DePauw Industries, 316 N. 7th St., St. Charles, Ill., or — **Circle Inform-A-Gram No. A74.**

A Hand Tool for bending leads on resistors, diodes, capacitors, etc., during assembly to accurately register with their holes in printed circuit panels is available. The No. 600 universal bending block almost



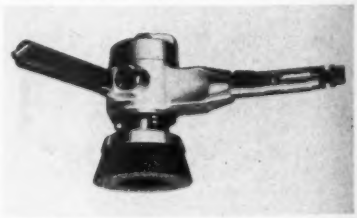
eliminates plier damage, saves time, and can be adjusted to any component body length from ¼" to 1¾". Leads can be bent to within 0.070" of end of component and up to 3" hole centers. By-Buk Co., 4314 W. Pico Blvd., Los Angeles 19, or — **Circle Inform-A-Gram No. A75.**

An Electromagnetic Chuck 2⅞" high has been announced by the Hanchett Magna-Lock Corp. Model CL provides maximum working height under the grinding wheel and is available in 7 sizes. Moisture proof



and shock proof, this chuck is furnished complete with rectifier and built-in switch. Model CL has a fine pole laminated top and the holding power is distributed to the extreme edges of the face plate. Hanchett Magna-Lock Corp., 484 Maple St., Big Rapids, Mich., or — **Circle Inform-A-Gram No .A76.**

Low Maintenance, long life, and simplicity of overhaul are some of the advantages of a 1500 series grinders. They have been designed for use in a variety of metal grinding, sanding, and wire-brushing operations. Lever-type thumb-tip throttle



provides effortless control of the tool without changing grip, and a special muffler handle reduces noise and serves as an air exhaust. The basic tool is available in a variety of speeds and for several different wheel and guard mountings. Cleco Air Tool Div'n, Reed Roller Bit Co., 5125 Clinton Dr., Houston 20, or — **Circle Inform-A-Gram No. A77.**

ON THE FINEST PUNCHES AVAILABLE—ANYWHERE !*

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CYLINDRICAL GROUND
HIGH SPEED STEEL
PRECISION PUNCHES

• Shoulder and ball seat punches with quality and performance only PIVOT can give! Point diameters ground to exacting standards. .0002" maximum T. I. R. guaranteed. Press fit and lead diameter built into shoulder punches. PLUS Pivot's exclusive hot-forged heads. Ball seat punches fit all standard ball seat retainers. Any quantity from one to thousands . . . at catalog list prices . . . as low as 76¢ each! Delivery? Look here:

48 HOUR DELIVERY
FROM RECEIPT OF ORDER AT FACTORY

* Prompt delivery on famous, exclusive PIVOT straightground or whipsleeved punches, too! (A week to 10 days).

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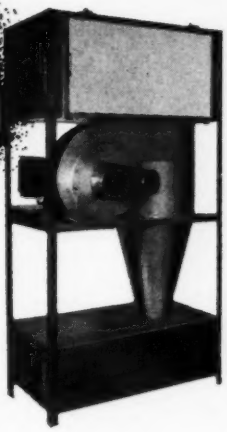
CIRCLE INFORM-A-GRAM KEY NO. 248

EFFICIENT–LOW COST

Dust Collection



Easy installation . . . efficient low-cost operation . . . simplified maintenance, make Dustkop *FIRST* among equipment to collect most all industrial dusts. There are Dustkop models to eliminate your dust problems . . . that are space saving, self-contained units, or exhaust type for rafter, ceiling or outside location. Write for descriptive literature.

DUSTKOP STOPS DUST

37 STANDARD MODELS TO CHOOSE FROM

• READY TO USE

Also a Complete Line of Mist Collectors

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1394 E. CHURCH ST. • ADRIAN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2491

D-R SMALL LOT STAMPING

FROM TEMPORARY TOOLS

SOLVES

A TOUGH COST PROBLEM

Converting from a casting to a sheet steel stamping reduced this customer's cost to one-tenth his old method.

Only 200 piece parts/year were needed, and an annual design change was a further possibility.

Dayton Rogers produced 100 pieces for less than the cost of the tool steel used in making a conventional die for such a part, *with superior results.*

GOT A DESIGN-ENGINEERING PROBLEM? SEND YOUR SKETCH, BLUEPRINT OR PART, PLUS QUANTITY, FOR PROMPT QUOTATION

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 2492

HIGHER SPEEDS/ FASTER GRINDING/

kipp

AIR GRINDERS

Model JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

kipp

MADISON-KIPP CORP.

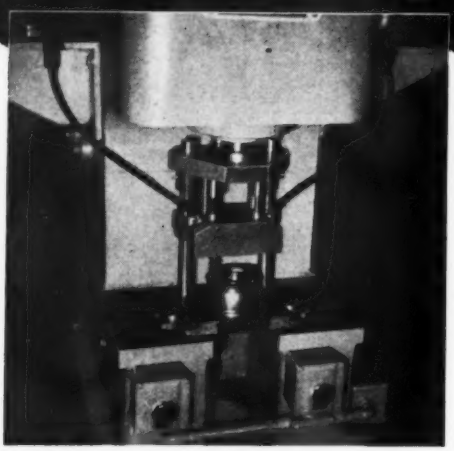
212 Waubesa St. • Madison 10, Wis., U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 2493

another example of ACME versatility

HYDRAULIC BENCH PRESS

automatically feeds two small pins simultaneously into transmission part



- Operator manually places transmission part into lower portion of die set fixture.
- Operator presses both electric control buttons and press ram automatically closes upper portion of fixture over work part, and presses two small pins into work part in predetermined position.
- Operator releases both buttons and fixture opens up for removal of completed part.

The small pins are automatically fed into the fixture by means of vibratory feeders at either side of the press frame. Operator handles only the major portion of the assembly.

Completed assemblies are produced at the rate of approximately 360 per hour.

Contact Acme today regarding your broaching machine, broach tooling or press problems

ACME BROACH CORP.
MILAN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 2501

DYKEM STEEL BLUE
Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead
THE DYKEM COMPANY
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$95.00
Handles stock up to 3" wide, 1/16" (app.) thick

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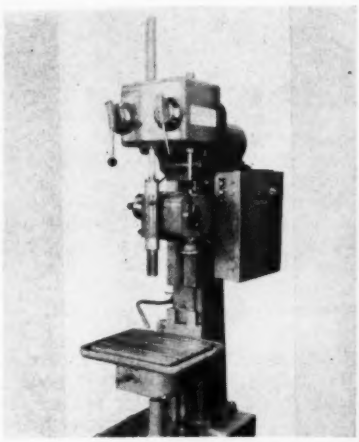
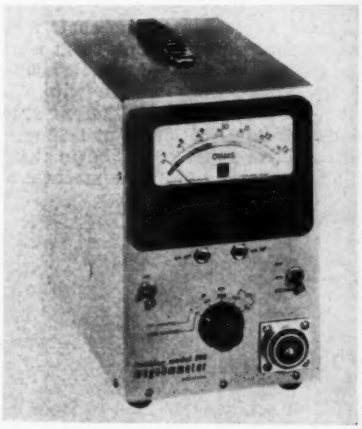
CIRCLE INFORM-A-GRAM KEY NO. 2506

A 21" Swing Upright Drilling and Tapping Machine is available in box column and round column types in both single spindle models and gang drills. The model N is designed to speed operations and handle a broader range of work. Single lever functional control gives fast, easy han-



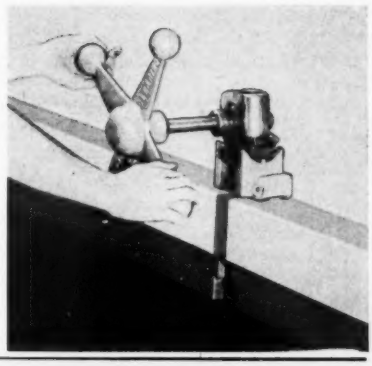
dling, and spindles speeds and feeds can be arranged for practically any job. A feature permits unlimited feed rates and provides all standard geared tap leads from 8 to 50 pitch. Cleereman Machine Tool Corp., 555 W. Washington Blvd., Chicago 6, or **Circle Inform-A-Gram No. A78.**

Many Production and Laboratory Tests can be made faster and more accurately with the model 510 megohmmeter. It measures six decades of resistance on a single 6" mirror scale and has 5 to 10 times faster response than conventional ohmmeters. Typical uses include rapid



checking of insulation resistance of motor windings, capacitors, transformers, cables, etc. Elimination of range-switching is one of the features of this model. Keithley Instruments Inc., 12415 Euclid Ave., Cleveland 6, or—**Circle Inform-A-Gram No. A79.**

Mount Punch Dies quickly and easily to press slides with a punch clamp. It can be permanently mounted to the slide flange of a press with three screws which remove all tensile loading from the three mounting screws. These clamps are available in two sizes, with 10- and 15-ton capacities. A minimum of four clamps is recommended for each press slide. Clearing Machine Corp., Div'n of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, or — **Circle Inform-A-Gram No. A80.**



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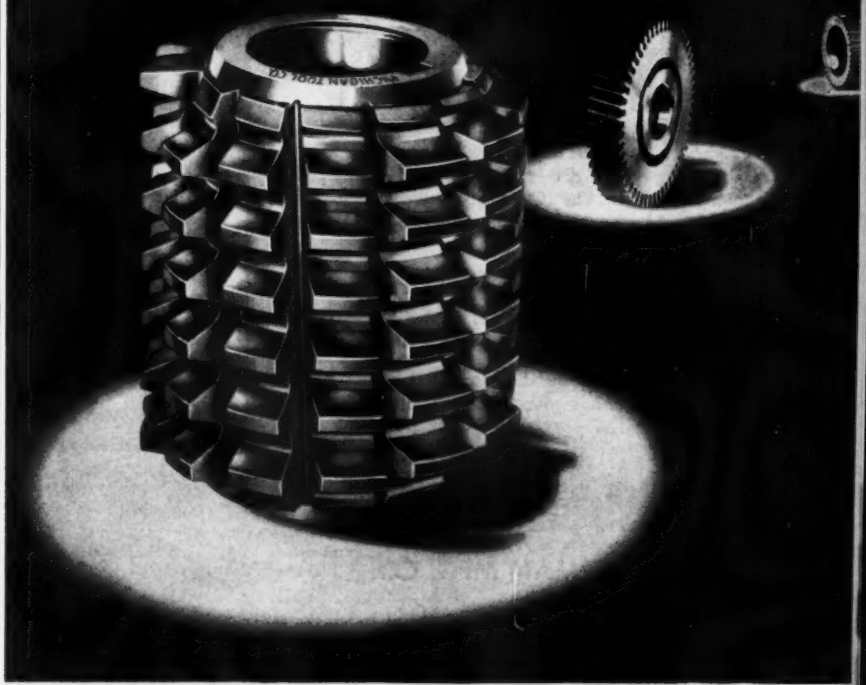
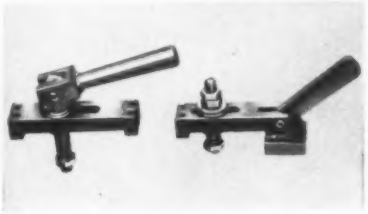
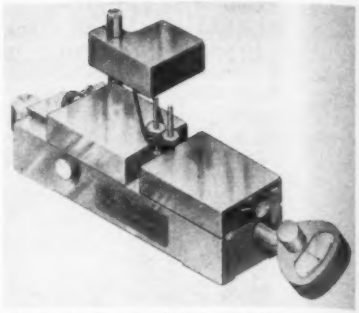


Cut Costs, Man-hours, and speed-up production with strap clamping assemblies. They feature a universal-type, highly maneuverable strap milled from solid stock and available with 5 interchangeable pads of soft stock. Secure, safe clamping of rough, finished, irregular surfaces is obtained, and are available from watchmaker's assemblies large enough to hold big machine tool jobs. Jergens Tool Specialty Co., 712 E. 163 St., Cleveland 10, or —
Circle Inform-A-Gram No. A81.

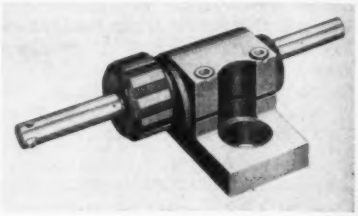


Gears Up to 3" Center Distance can be accurately and economically checked during production with the fine pitch gear rolling instrument. Errors can be evaluated and corrected on the spot which saves inspection rejects and remachining costs. The instrument's Mikrokator



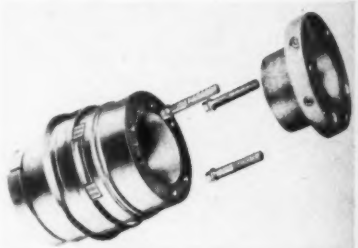
dial gives readings calibrated in 0.00002". An indicator calibrated in 0.00001" is also available if desired. This instrument is designed to withstand rugged production line use. Machine and Instrument Div'n, Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, or —
Circle Inform-A-Gram No. A82.

Designed for Quick Mounting on the lathe's compound tool post, a lathe boring bar holder utilizes the power feed on the carriage. Being mounted on an eccentric, the boring bar holder can be easily adjusted by



simply repositioning the eccentric to get the best cutting results from the tool. The holder accommodates round boring bars from ⅜" to 1" diameter. The bar can be adjusted for various depths. Universal Engineering Co., Frankenmuth, Mich., or
Circle Inform-A-Gram No. A83.

Easy Fastening to the shaft with the firmness of a shrunk-on fit is an advantage of a line of flexible couplings taper-bored for use with OD taper bushings. Six different sizes range from 22 to 150 hp at 1750 rpm. Stock bushing bore sizes begin at ½" and progress to 3½" by sixteenths of



an inch. Other advantages include reduction of normal stock requirements of coupling bodies and immediate availability of a wide range of shaft sizes. Lovejoy Flexible Coupling Co., 4979 W. Lake St., Chicago 44, or—**Circle Inform-A-Gram No. A84.**

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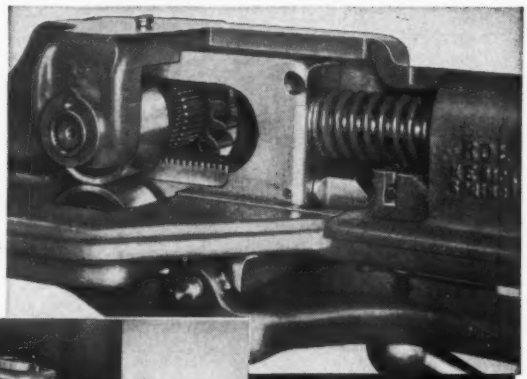
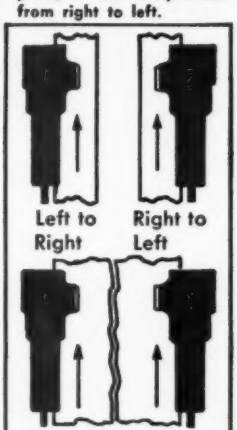
at SMALL COST!....



Dickerman 12" Rol-Di-Feed, conventionally mounted on the bolster of a punch press, to feed strip stock from right to left.



Double Feed for unusually wide stock

Here's a new, versatile feed designed to outperform others costing up to 8 times more! The Dickerman 12" Rol-Di-Feed is easily installed on any punch press. This new feed handles with equal ease such different materials as paper, plastic, or cold rolled steel—in thicknesses ranging from .003" to 3/16" in any type of die—piercing, blanking, compound, progressive or draw. The 12" Rol-Di-Feed feeds on the press upstroke and on the downstroke, permitting accurate stock feeds up to 12" per cycle.

Open side design accommodates stock of almost any width. 12" Rol-Di-Feed can be mounted to feed in any direction ... or installed in pairs to handle unusual sizes and types of stock. For greater production and profits, eliminate costly "special" feeds—install the new standard Dickerman 12" Rol-Di-Feed on all your press equipment!

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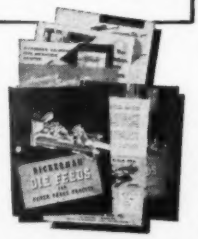
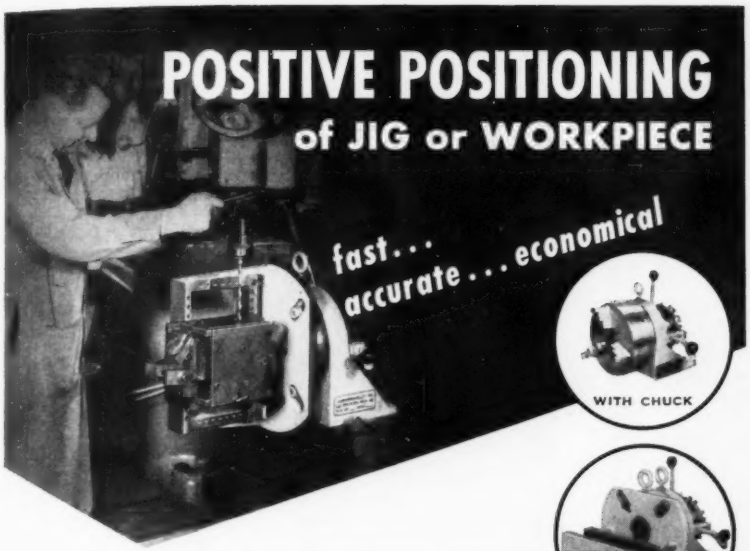


CIRCLE INFORM-A-GRAM KEY NO. 252

POSITIVE POSITIONING
of JIG or WORKPIECE



This J&B Indexing Trunnion, complete with built in station selector, will increase production speed and accuracy on your drilling, tapping, or counterboring operations.

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J&B EST. 1870

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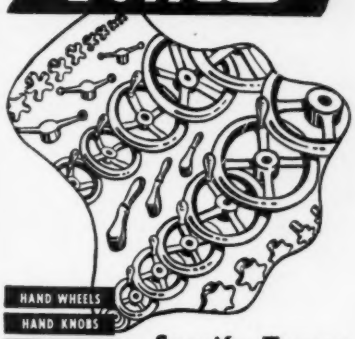
PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 2531

Tomco



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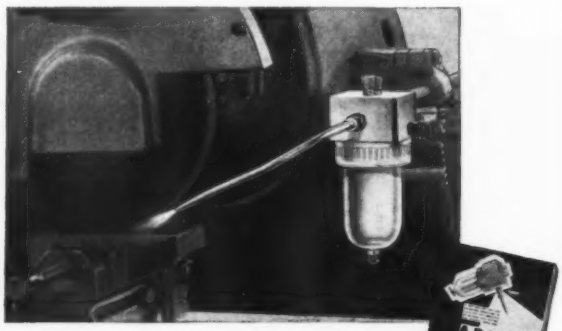

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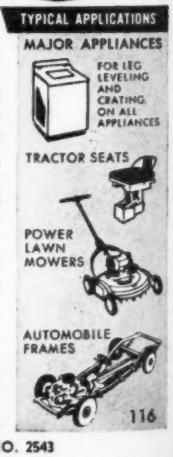

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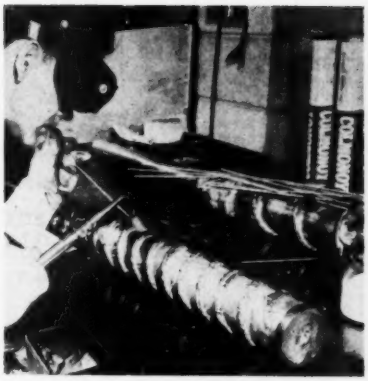

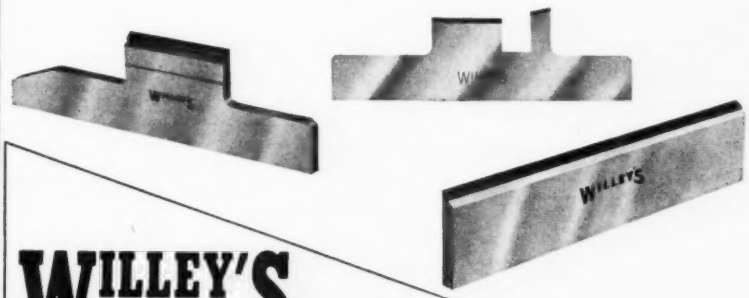

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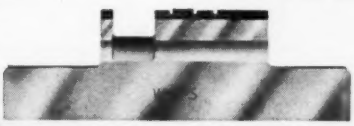

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Designed for Production Chilling, the low-temperature chilling machine is used to achieve complete stability and maximum hardness in

the metallurgical processing of metal parts. Model 10L-2 has 19 cu ft capacity with a 30" x 24" x 24" chamber. The chamber can chill parts by liquid immersion, or in air. Capacity is available to chill quantities of steel at the rate of from 100 lbs/hr. Harris Refrigeration Co., 308 River St., Cambridge, Mass., or —
Circle Inform-A-Gram No. A91.

SCHERR
PRECISION MEASURING TOOLS

NON-ROTATING SPINDLE BLADE TYPE MICROMETER HEAD

TUMICO

to be built into fixtures, machine tools, delicate instruments and cross-slides.

NON-ROTATING SPINDLE BLADE TYPE MICROMETERS

Spindle moves but does not turn!

TUMICO

For Measuring of narrow depth grooves, slots, keyways, splines, square threads, recesses and similar hard-to-measure surfaces.

BLADE THICKNESS .030" GAGING DEPTHS TO 1/4"

Available Carbide-tipped

Spindle and Anvil Blades are hardened, ground and lapped to contact fit

Graduated in .001" Ranges: 0-1", 1-2", 1½-2½", 2½-3½" 3½-4½" and others

Mandrel Type MICROMETER Sets

with TUBULAR Frame for • EXTRA STRENGTH • LIGHT WEIGHT

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Each Set has a range of 6" and is equipped with setting Standards & mandrels in finished wooden case

Available from 6" to 96"

Light Weight Frames For Extra Large Sizes

Sold thru Tool Supply Houses WRITE FOR ILLUSTRATED FOLDER

NEW MICRO PROJECTOR

GEO. SCHERR CO., INC.

200-T LAFAYETTE ST. • NEW YORK 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2611

Commander
TAPPER

★ Wider Range...1 Tapper Handles #0 to 3/4" Taps

★ Automatic Tap Protection

★ Furnished to fit any Drill Press

Commander—"The Tapper That Thinks For Its Operator," has the adjustable full range torque control that instantly stops any tap when it becomes dull, loaded, strikes a hard spot or bottoms in blind hole tapping. Assures maximum tap protection, higher production, even with inexperienced operators.

Your nearby Commander Distributor can give you a demonstration in your own plant. Write for his name and a copy of the NEW Commander Full Line Catalog.

COMMANDER MFG. CO.

4228 W. Kinzie St. Chicago 24, Ill.

Product of Commander... Builder of Production Tools

CIRCLE INFORM-A-GRAM KEY NO. 2613

announcing...

TRIGGER-RELEASE levers on 5 more

DE-STA-CO

PORTABLE TOGGLE CLAMPS

MODEL 462

Trigger-Release levers also available on DE-STA-CO Toggle Clamp Models 461, 462-S, 463, and 463-S (jaw spans ranging from ½" to 3").

For a one-handed clamping job . . . especially in a hard-to-get-at place . . . there's *nothing, absolutely nothing,* as good as a Trigger-Release DE-STA-CO Portable Clamp! . . . And now, with 5 more new models, we meet practically every such clamping requirement.

FOR COMPLETE INFORMATION, WRITE FOR 40-PAGE CATALOG AND NEAREST DE-STA-CO DEALER!...

TOGGLE CLAMPS

DE-STA-CO DETROIT STAMPING COMPANY

WORLD'S FIRST LINE OF TOGGLE CLAMPS

344 Midland Avenue • Detroit 3, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2612

new ELASTICONE® guide pin covers CUT DIE COSTS 25%

reduce lubrication
reduce maintenance
increase press time
preserve alignment

Discover how inexpensive ELASTICONES can provide increased production, lower die costs by closing the gaps between pins and bushings, reducing die breakage and maintenance. Just snaps into place — no installation or maintenance costs! Bulletin 53 contains complete information. Send for it today!

CENTRAL Safety Equipment Co.

6603 MARSDEN ST. PHILADELPHIA 35, PA.

For complete information on Elasticones and a copy of Bulletin 53 use convenient coupon.

Name_____ Title_____
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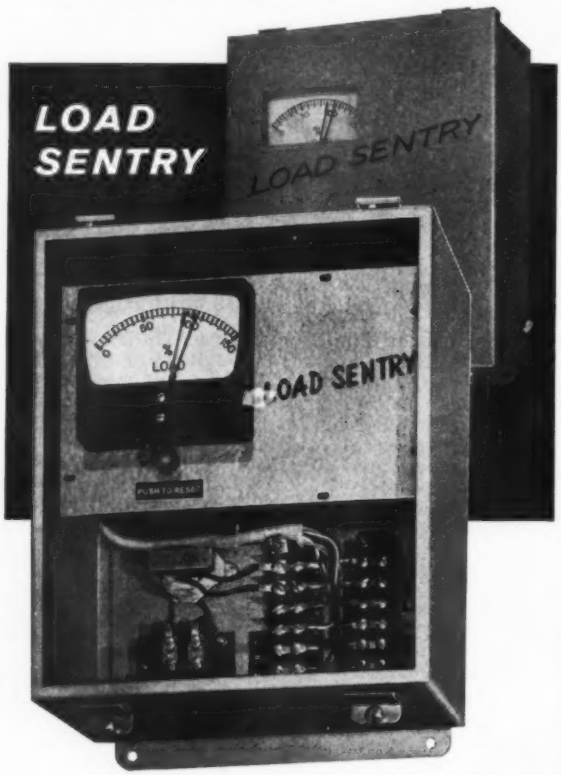
Address_____
City_____ Zone____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 2614

NEED OVERLOAD PROTECTION?



Load Sentry, NEMA 12 Housing, price $225.00

With one pointer, you set the load limit anywhere on the dial. Another pointer shows running load on the motor. If an overload occurs, these pointers meet and a protective circuit is energized, or feed rate is changed, or the motor is shut down, as preferred.

EASY TO INSTALL: Eight easy connections to make—any plant engineer, electrician or maintenance man can do it.

ACCURATE: Meter-relay "heart" is able to detect two pieces of stock moving through a progressive die; 2% load increase will trigger protective circuit.

SAFE: After overload, an interlock prevents start-up until overload is cleared and reset button is pressed.

FAST: Shutdown or alarm is virtually immediate if overload occurs.

UNAFFECTED BY STARTING SURGE: No false shutdown while motor is drawing heavy starting current.

TO ORDER: Specify motor full load current; or horsepower, voltage, and phase.

Ask for Data Sheet 7-A

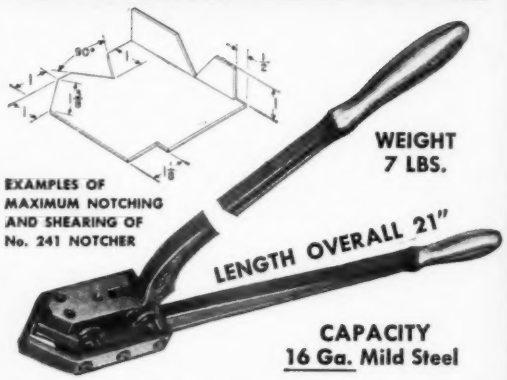
ASSEMBLY PRODUCTS, INC.
75 Wilson Mills Road • Chesterland 64, Ohio
Telephone: (Cleveland, Ohio) HAmilton 3-4436 and 3-4446

Booths 217-218, National Electronics Conference, Oct. 7-9 Sherman Hotel, Chicago, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 2621

EASY-WORKING, POWERFUL

WHITNEY-JENSEN No. 241 HAND NOTCHER



Useful for a lot of different notching operations, as shown by examples of side, corner, and flange cuts. Very efficient on corner moulding, also shallow sheet metal channels. The curved blade hooks to a point that will engage a punch prick for exact location of notch.

WHITNEY METAL TOOL CO. *Since 1910*
712 FORBES ST., ROCKFORD, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 2622

Magna-tip® MAGNETIC SCREW DRIVING ACCESSORIES

Increase Output of Any Power Driver

Magna (magnetic) bit holders, finders and sockets fit all power screwdrivers... save money by speeding assembly operations. Permanent, high energy magnets hold screws, bolts or nuts...permit the operator to drive them home without prepositioning or fumbling Made for all types and sizes of screws and hex nuts. Ask your power screwdriver salesman to show you these handy Magna accessories.

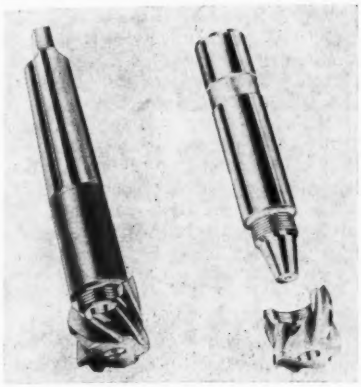
WRITE *for manual on the complete line of Magna-Tip bit holders, finders, sockets and hand screwdrivers: Dept. 88G, Magna Driver Corp., 779 Washington St., Buffalo 3, N. Y.*

CIRCLE INFORM-A-GRAM KEY NO. 2623

"THROW-AWAY" REAMER USED FOR DIFFICULT STAINLESS STEEL JOB

Prior to the use of a new reamer with a "throw-away" head, it was necessary to use special reamers, core drills, and expensive boring tools — all with unsatisfactory results.

The successful use of this Tomkins-Johnson reamer with its special head and long shank has been reported by the Western Electric Company on a difficult and unusually long boring job in stainless steel.



Specifications called for a 17½" hole drilled to an ID diameter of 0.931 ±.001, to be round, straight, and have a 63 micro-inch finish or better. Engineers reported that the "throw-away" head reamer maintained a true diameter the entire length with an average 32 micro-inch finish. The reamer, being removable from a common shank, makes size change or replacement a simple operation. Economy is also a factor as only the reamer head need be replaced in contrast to a one piece reamer unit. It is offered in a wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments—right or left hand spiral flutes.

Two Brown & Sharpe engineers form a team to better the efficiency of the company's automatic screw machine production in customers' plants. Walter E. Rollins, supervisor of screw machine sales projects, and his assistant, Oscar T. Lippman, will offer on-the-job studies of customer problems and help customers secure maximum efficiency, reduction of production costs, and elimination of secondary operations wherever possible.

at 1/5 the cost
with 1/5 the skill
in 1/5 the time
NO
CALCULATIONS
Simple 4-step
Method

In effect, the Rahn Planekator suspends a perfect plane over your surface plate. All you need do is take indicator readings between plane and plate at desired positions, record them, and there's your calibration.

Dependable surface plates are your guarantee of dependable inspection. With a Rahn Planekator you can be sure of their accuracy.

RAHN GRANITE SURFACE PLATE COMPANY
638 N. WESTERN AVE., DAYTON 7, OHIO
CIRCLE INFORM-A-GRAM KEY NO. 2631

CUT
PRODUCTION TIME!

Use these Handy PORTABLE, ELECTRIC RECIPROCATING TOOLS for Greater Production, Better, More Uniform Work — All with less Operator Fatigue. Fixed strokes are 1/8" or 3/8" long. Operate on 110 Volts AC-DC. Deliver 1000 PUSH-PULL strokes per minute. Try one of these tools on your next job.

Send for Descriptive Literature

ACME TOOL COMPANY
75 WEST BROADWAY NEW YORK 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2632

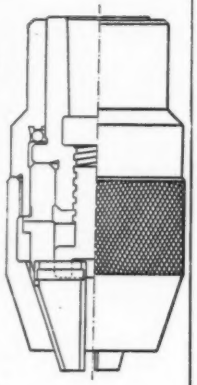
THE RAPID

A Superior Swedish Drill Chuck

For the finest JIG BORERS or other machines

WHEREVER UTMOST AVAILABLE ACCURACY COUNTS

- Automatic tightening and self centering with load
- Easy to open — *No Key* to misplace or to invite accidents
- No chewed up tool shanks
- All parts properly hardened and Precision Ground
- Arbors Precision Ground between centers



The Chuck of TODAY for the most demanding operators!

Sole U.S.A. Representatives:

NEISE MODERNTOOLS **KARL A. NEISE** 404 Fourth Avenue New York 16, N. Y., Dept. TP

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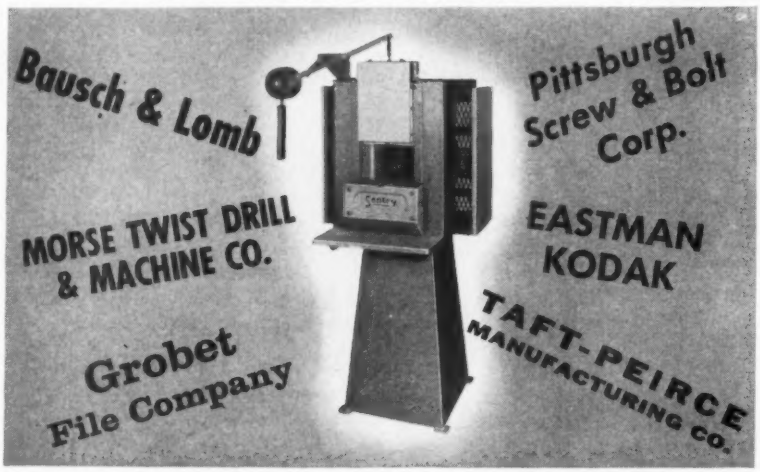


Quality Tool Hardeners Choose Sentry Furnaces

For High Speed Steel tool hardening many of the country's leading manufacturers rely on Sentry Furnaces. *The Sentry Diamond Block Atmosphere makes the difference.*

The chemically constant and truly neutral Sentry Diamond Block Atmosphere permits ample soaking at hardening temperatures to assure maximum hardness in all high speed or air hardening steels. Tools retain their initial sharp, clean-cut edges absolutely free from scale or decarb, with no atmosphere regulation or analysis required.

Consistent high quality tool hardening reduces production costs. That's why leading manufacturers choose Sentry Furnaces.

Avail yourself of Sentry quality. Consult Sentry for free demonstration hardening on your own tools.

Visit us at Booth 150, The 39th Metal Exposition, Chicago, Nov. 4-8

Sentry ELECTRIC FURNACES

TRADEMARK

Request Catalog Y-43 • Write **THE SENTRY CO., FOXBORO, MASS.**

CIRCLE INFORM-A-GRAM KEY NO. 2642

FILMS TO SEE

A color film on modern steelmaking in Sweden is made available by Uddeholm Company of America. The film covers the steelmaking process — from the mine to the finished product. The 16mm film runs for 30 min. Contact Uddeholm Company of America, 155 E. 44th St., New York 17.

•

"Work Simplification on Film" is a 20-page brochure describing 60 films on the work simplification methods of some American industrial concerns. The films show before and after sequences, and how work simplification techniques solved problems and lowered costs. Both office and plant situations are described. All the films are 16mm and run from 10 to 15 min each. Write to Industrial Management Society, 330 S. Wells St., Chicago 6.

•

A technique of repairing aluminum honeycomb structure under field conditions is demonstrated in a new color film. A 4-hr repair operation is reduced to a 10-min sequence. These steps are shown: removal of damaged material, application of adhesive in the void, bonding a patch over the hole, and checking the bond. The method can be used for repairing damage for all sizes and shapes. The film is loaned free of charge by Presentations Section, The Martin Co., Baltimore.

•

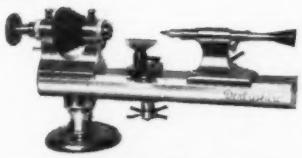
"Tooling the Band Saw for Production" describes the versatility of the band saw in the accurate removal of metal. The 16mm color film shows how these cost-cutting machines provide another concept in machining operations requiring shaping, slotting, splitting, or facing. It describes the slotting of hydraulic pump rotors with the aid of a simple indexing fixture for moderate production and more elaborate fixturing for automatic operation. The film is 10 min long and is loaned by The DoAll Co., Des Plaines, Ill.

•

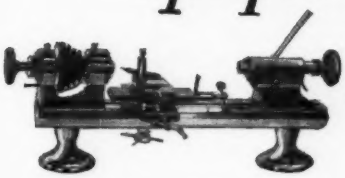
The interchangeable application of automated processing to office machines produced by 14 manufacturers of office machines is the subject of a film. This 35-min film, makes it easier to judge the adaptability of office automation to an individual organization's specific requirements. The National Office Management Assoc., 1931 Old York Rd., Willow Grove, Pa., has set up a low-cost rental plan for the film.

Write for full details

Derbyshire *fine precision equipment*

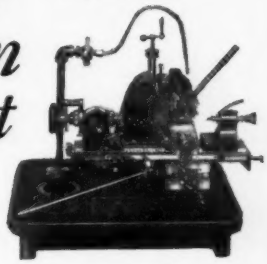


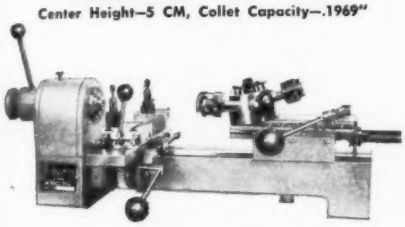
WEBSTER WHITCOMB 12" BED
Center Height—5 CM, Collet Capacity—.1969"



ELECT LATHE — 18" BED
Center Height—2.35" (6 CM)
Chuck Capacity—.004" to .315"

MICROMILL
2 Table Surfaces: 7⅞" x 2⅜" — 12" x 2⅜" — Takes Magnus Collets.

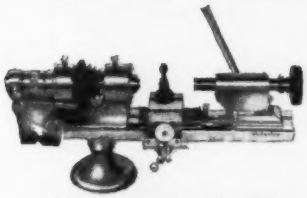




MODEL No. 750 — 22" BED
Center Height — 7.50 CM, Collet Capacity — .315"

If you have a problem...

. . . concerning small precision turning or milling, one of these lathes or the milling machine shown should solve it. Write for Catalog.

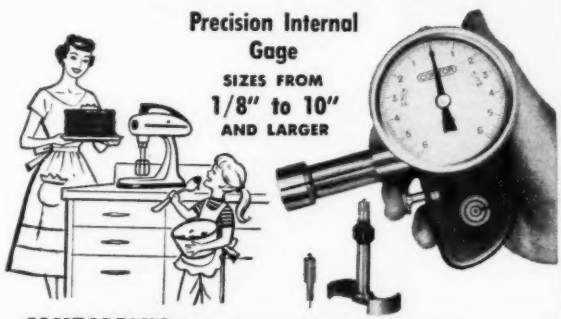


MAGNUS LATHE — 12" BED
Center Height — 5 CM
Collet Capacity — .315"

F. W. DERBYSHIRE, INC.
157 HIGH STREET
WALTHAM MASS.

CIRCLE INFORM-A-GRAM KEY NO. 2651

Well-known makes of home appliances are gaged with Comtorplug



COMTORPLUG. Interchangeable expanding plugs gage simple or special bores from ⅛" to 10" diameter.

UNIQUE ADVANTAGES

- Large dial with .0001" graduations.
- Indicates actual size, a fixed — not passing — reading.
- Portable — no wire, hoses, stands or electronic gear.
- Positive 2-point gaging — automatic centering.
- Assured accuracy regardless of who operates it.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Will gage work in the machine.
- A shop tool for all-day every day use.

Anybody can use Comtorplug with positive accuracy . . . at machine, bench, lab . . . anywhere, since it's unencumbered by wires, hose, heavy base or electronic gear. The same amplifier fits all plugs and fixed readings show ACTUAL SIZE, front or back taper, ovality, etc. Whatever problem bore you have in mind, COMTORPLUG may be the answer.

COMTOR COMPANY
82 Farwell St.
MASS.
WALTHAM 54

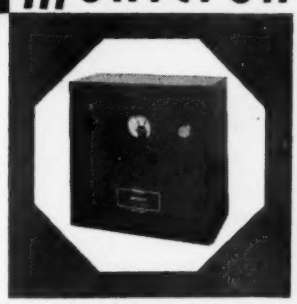
GET THE FACTS — REQUEST BULLETIN 50

CIRCLE INFORM-A-GRAM KEY NO. 2652

STOP

damage to machinery with automatic protection...a

Sperry **monitron**



Stop damage from pile-ups, misfeeds, dull tools, oversize stock, faulty lubrication, etc.

Monitron senses load increase or decrease, stops motor, releases clutch, applies brake — before damage is done.

Monitron protects electrically driven presses, dieing machines, conveyors, pumps, automatic machine tools. Send coupon for full information.

Sperry **SPERRY PRODUCTS, INC.**
Danbury, Conn.

Please send me complete data on the Sperry Monitron.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____ TPIO

CIRCLE INFORM-A-GRAM KEY NO. 2653

Flexolap.. INSTANTLY AND ACCURATELY

ADJUSTABLE FOR FAST LAPPING AND POLISHING

. . . without danger of galling or seizing!

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.

Illustrated at left is Flexolap Set No. 1. Includes 6 complete laps, one of each size (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"), and one additional brass barrel of each size, all held on a sturdy, serviceable stand. Price complete $14.00

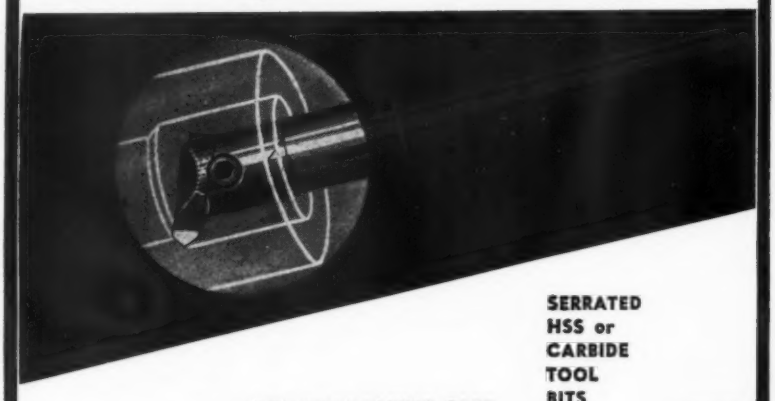
Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 3/16", use the Midget Lap. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps) $2.10

Write today for Catalog

FEDERAL TOOL CORP. 3600 Pratt Blvd., Chicago 45, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 2661

Newest Development in Precision Boring Tools



NEW "BH" BORING BARS

overcome the major disadvantages of conventional bars:

- Both clamp and insert are serrated to insure the firmest grip possible, even with little pressure on the clamp.
- New advanced clamp design eliminates strain on the inserts and prevents breakage of tool bits.
- Carbide and HSS inserts have a half-elliptical shape for better side clearance and more strength, less chatter.

Write for free catalog to:

SERRATED HSS or CARBIDE TOOL BITS

IN CANADA
CANADIAN M. S. E.
171 Kipling Ave. S.
Toronto 18, Ontario

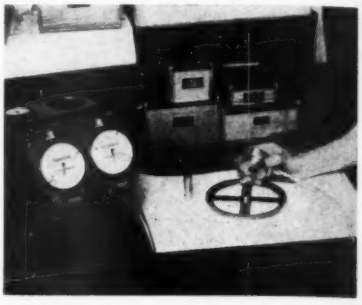
R. B. TOOL Co., Inc. 785 North Broadway White Plains, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 2662

DIMENSION AND TAPER ON PRECISION HUB CHECKED TO .0001"

The shape and small size of a gear allowed micrometer measurement of the outer portion of the hub OD. However, precision requirements of the part demanded that the OD dimension along the entire hub be checked.

The gear is used on the Man-Au-Trol bracket of a Bullard vertical turret lathe. A specially designed air ring solved the problem by having a pair of measuring air jets close



to the bottom of its bore. By raising or lowering the ring, the operator can speedily measure the OD anywhere on the hub to 0.0001". The ring is connected to a Dimensionair air gage manufactured by Federal Products Corp. One master, pictured at left of gear, is used for zeroing the gage.

The air gage, shown here as a dual unit with a common air supply and common pressure regulator, is also used for measuring taper. A taper plug or ring contains two pairs of air jets, with each pair tied into its own air meter. One master is used for zeroing the gage. The operator then reads any variations in taper directly on the air meter dial scales.

Star Stainless screws have clean—bright and—shiny—heads

STAR STAINLESS SCREW CO.

CORROSION RESISTANT

679 Union Blvd., Paterson 2, N. J.
Telephone: Little Falls 4-2300
Direct N. Y. Phone: WI 7-9041

CIRCLE INFORM-A-GRAM KEY NO. 2663

For Heat Treating Small Parts

HUPPERT

DeLuxe

ELECTRIC FURNACES

• Here's a series of compact durable furnaces that are ideal for tool and die shops and small laboratories. Any desired temperature within the range of 300° to 1900° F. is controlled by an accurate, built-in Huppert temperature controller. All-steel construction—multi-insulation—sturdy Kanthal elements—counterweighted doors—removable porcelain tray.

Write today for literature on complete line of Huppert furnaces and ovens in five- and b nch models. Ask for Hints on Heat Treating.

Model No.	Inside Dimensions			Temp. Range	Watts 110 Volts AC	Price
	Wide	High	Deep			
434DL	4½"	3½"	4¾"	300°—1600° F.	920	$ 90.00
439DL	4½"	3½"	9"	300°—1600° F.	1650	120.00
436DL	4½"	3¾"	6"	300°—1900° F.	1650	130.00
5DL	4½"	3¾"	9"	300°—1900° F.	1750	176.00
9DL	6"	6"	6"	300°—1900° F.	2200	200.00
669DL	6"	6"	9"	300°—1900° F.	3000	248.00
10DL	8"	4"	6"	300°—1900° F.	2000	220.00
849DL	8"	4"	9"	300°—1900° F.	3000	265.00

Available for 220 Volt AC at small additional cost.
Stainless steel housing slightly higher.

K. H. HUPPERT CO.

6820 Cottage Grove Avenue, Chicago 37, Illinois

Manufacturers of Electric Furnaces and Ovens

CIRCLE INFORM-A-GRAM KEY NO. 2671

TAKE THE TOOLS TO THE JOB-

NOT the Job to the Tools!

with the

WRIGHT PORTABLE MAINTENANCE BENCH

CENTER-HOLE RAM and PUMP may be detached and used as a portable power unit.

50 FOOT AUTOMATIC RETRACTABLE CORD

FLOOR LOCK BRAKE

4 INCH SWIVEL MACHINISTS' VISE

SIZE: 24" Wide x 36" Long x 35" High

"Do it the Wright Way"

Equipped with

20-TON OPEN THROAT HYDRAULIC PRESS

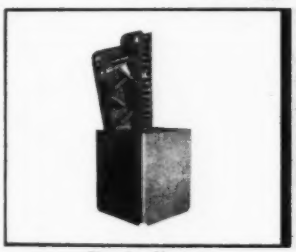
• Now by moving work bench and tools directly to the job, you REDUCE COSTLY DOWN TIME and SPEED UP MAINTENANCE OPERATIONS BY 95%.

Write for Literature

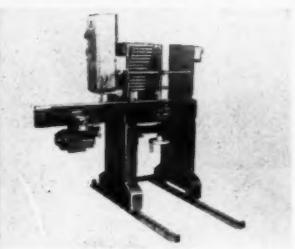
WRIGHT TOOL CO. 4316 N. Woodward Ave. Royal Oak, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 2673

Automatic Parts Feeding Machines...



Elevating Hopper



Magazine Loader

. . . Engineered to completely "Automate" your production machines

■ The automatic feeding equipment designed and built by PRODUCTION FEEDER eliminates costly, time consuming manual handling and loading . . . permits you to take full advantage of the production capacity of your machine tools. There is a complete line of specialized feeding machines that will properly orientate, perfectly cycle and quickly transfer bolts, screws, bushings, forgings, castings, bars, tubing, etc., to your production machines.

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PRODUCTION FEEDER Corp.

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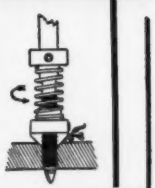
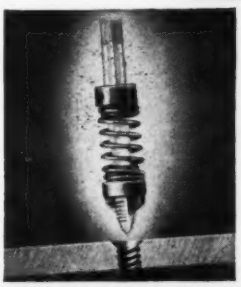
CIRCLE INFORM-A-GRAM KEY NO. 2672

TAP AND DEBURR IN ONE OPERATION

Slip a BURR-BIT onto any make tap and holes are automatically deburred while they are being tapped. Save money, time and labor by COMBINING TWO OPERATIONS INTO ONE.



AS TAP IS WITHDRAWN, BURR-BIT DEBURRS, LEAVING CLEAN CHAMFER



First thread which creates burr, has been AUTOMATICALLY, QUICKLY AND PRECISELY REMOVED, leaving perfectly smooth finish for easy screw insertion.

Precisely engineered of finest quality high speed tool steel for use on almost every material. The BURR-BIT is used by many large and small manufacturers throughout the country.

For full information and specifications on the BURR-BIT, write to

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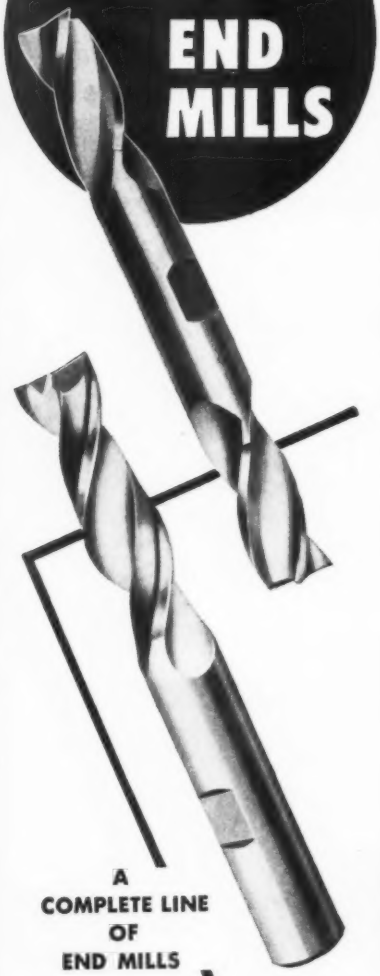
ESTABLISHED 1916

ARROW END MILLS



A COMPLETE LINE OF END MILLS

Since 1916 Arrow has been a major supplier of End Mills — one of the oldest because Arrow has always been one of the best.

The Arrow line consists of all type of End Mills plus H. S. Steel and Carbide Tipped Specials.

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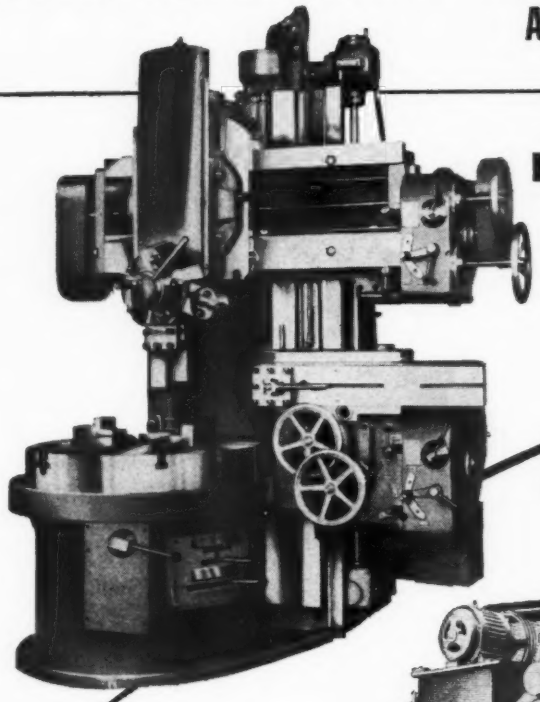

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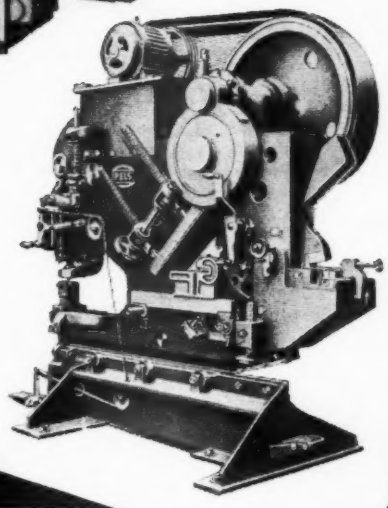

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"A Few Exclusive Territories Still Open To Dealers"

CIRCLE INFORM-A-GRAM KEY NO. 2682

DOWN PAYMENTS REDUCED IN NEW FINANCE PLAN

Pratt & Whitney's broadened time-sales financing program, developed with C.I.T. Corp., includes a depreciation-geared plan with terms to 10 years and down payment requirements as low as 10%. Reason for the extended plan, according to Edward P. Gillane, president of P & W, is the fact that increasing tightness in the money market makes it necessary to give many machine tool users greater flexibility in financing major purchases.

Under the new program, both Pratt & Whitney and its subsidiary, Potter & Johnston Co., will continue to offer terms of up to five years calling for equal monthly payment. Purchasers, however, may elect up to 10 years on a "pay-as-you-depreciate" schedule geared to the sum-of-the-digits method of depreciation.

THE LOW COST *Impact* AIR HAMMER

CUTS COSTS AMAZINGLY IN

- ASSEMBLING
- EMBOSSING
- FORMING
- PUNCHING
- BLANKING
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- PEENING
- RIVETING
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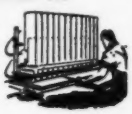
- FORGING
- MARKING



Most jobs done on expensive, heavy presses can *now* be done faster and cheaper by the light low-priced Mead Air Hammer using the new adjustable, spring*less* "Bullet Velocity" MEAD AIR TRIP! It delivers blows equivalent to 7½ tons down to as little as a few ounces—at several blows per second, if desired! Enjoy the *competitive benefits* of really low cost production with durable, powerful, improved Impact Air Hammer. Put Mead "how-to-do-it" experience to work for you.

Write Factory Now For Nearest Mead Man Name and Cost-Cutting Bulletin No. HA-107

MEAD

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4114 N. Knox Ave., Dept. HA-107 Chicago 41, Illinois

Pathfinder in AIR POWER AUTOMATION

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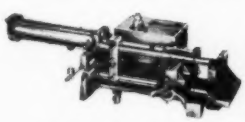
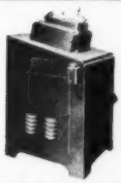
BOOST POWER PRESS PRODUCTION!

These Components Reduce Material Handling Costs, Save Floor Space and Permit Continuous Flow Operation.



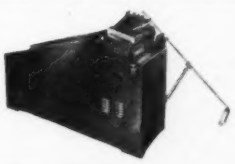
AIR OPERATED SLIDE FEEDS

MECHANICAL SLIDE FEEDS



SMALL PARTS STRAIGHTENERS

SCRAP CHOPPERS



STOCK CRADLE AND STRAIGHTENERS

PORTABLE STOCK STRAIGHTENERS

WRITE FOR INFORMATION ON ANY OF THESE PRODUCTS TO

COOPER WEYMOUTH, INC.
600 HONEYSPOT ROAD • STRATFORD, CONN.

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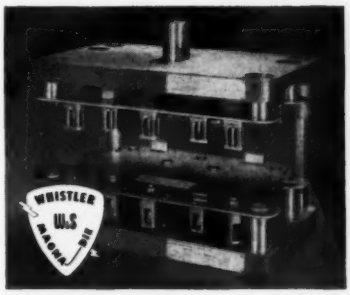
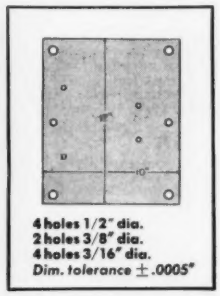
WHISTLER MAGNA-DIES open the way to big savings

Over $2500 saved on these four typical jobs... Here's a specific example showing how Whistler Magnetic Perforating Dies are used and re-used to push die costs down to a rock bottom low:

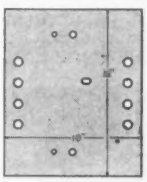




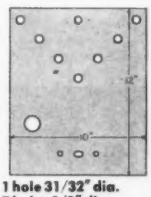
4 holes 1/2" dia.
2 holes 3/8" dia.
4 holes 3/16" dia.
Dim. tolerance ±.0005"

$106 SAVED ON JOB NO. 1...EVEN INITIAL INVESTMENT IS LESS

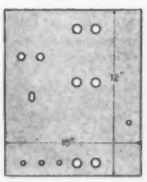
This Whistler Magna-Die unit includes a 12" x 14" die set, 10 punch and 10 die retainers, 10 punches, 10 die bushings, 10 strippers, 3 gages and one set of templets. The complete price with templets jig bored and gages mounted for producing the 10-hole part shown above: $819.00. The approximate cost of a custom die to do the same job: $925.00. From the very start, you start to save with a Whistler Magna-Die.



8 holes 1/2" dia.
2 holes 3/8" dia.
2 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"



1 hole 31/32" dia.
7 holes 1/2" dia.
1 hole 3/8" dia.
2 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"



6 holes 1/2" dia.
2 holes 3/8" dia.
4 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"

$710 SAVED ON JOB NO. 2. All of the original punch and die parts (with the exception of 2 punches, 2 bushings and 2 strippers) are re-used here. The additional tooling required, plus bored templets with gages mounted, cost $389.79. The approximate cost of a custom die to produce this part: $1100. *Savings pile up with each succeeding job...$816 so far.*

$793 SAVED ON JOB NO. 3. Through the use of another punch and die retainer unit, a 31/32" punch, die bushing and stripper plus a new set of bored templets with gages, this part is produced at a die cost of $246.81. In this case, the cost of a custom die would amount to approximately $1040.00. *Savings now reach $1609.*

$925 SAVED ON JOB NO. 4. As more Whistler punch and die parts are accumulated, die costs for each succeeding job usually go down even further. Here, for example, only a new set of templets, jig bored to the 13-hole pattern, is needed. The cost: $163.55. A custom die for this job would run approximately $1089.00. Total savings for these first four jobs alone amount to approx. $2585.

EACH JOB CAN BE RE-RUN AT ADDED SAVINGS, TOO!

Punch and die parts can be quickly re-assembled to re-run any one of these four jobs. All it takes is approximately 10 minutes for press changeover. Whistler Magna-Dies cut downtime and remove production bottlenecks by avoiding the extra time required to obtain custom dies. They can be used on practically any press with a minimum shut height of 9½" for perforating materials up to and including ¼" mild steel.

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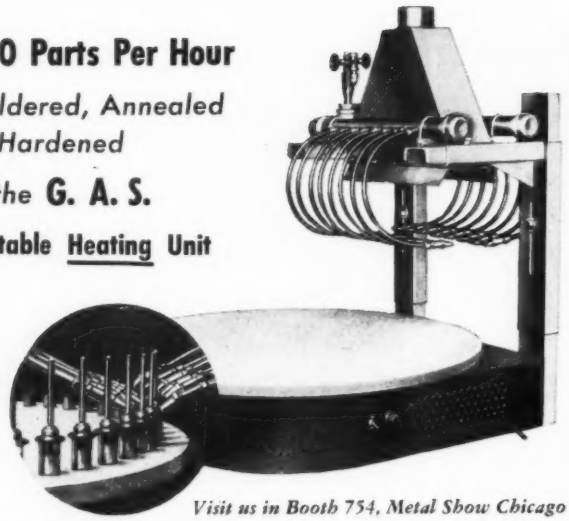
Brazed, Soldered, Annealed or Hardened

with the **G. A. S.**

Utility Turntable Heating Unit



Close-up of unit silver-brazing a gasoline drain and feed pipe assembly at a production speed of 450 units per hour.

Visit us in Booth 754, Metal Show Chicago

This high output, low cost unit will heat up to 1,000 parts per hour depending on the size and shape of the part. Then, when you are through with production on one part, in 5 minutes time the unit can be changed over to another — it is just that easy.

Simple fixtures on the transite hold the work. When changeover is required, the transite complete with fixtures, is easily removed and replaced by another complete setup.

The gas manifold with its 16 burners is quickly adjustable horizontally and vertically to suit different parts.

The turntable drive is variable to meet various heat requirements.

This is one of the many versatile, efficient production heating units built by G.A.S. and requires only a small initial investment. Learn how it will answer your production heating problems — write for Bulletin No. 512.

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Industrial Gas Engineers

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- *high production*
- *uniformity of finish*

Savings on deburring, descaling, grinding, polishing, coloring and surface improvement by Roto-Finish barrel finishing processes are tremendous. Expensive hand finishing can be eliminated.

Results Guaranteed ! Send samples of finished and unfinished parts to Roto-Finish. Roto-Finish Sample Processing Laboratories will prove to you — before you buy — that Roto-Finishing will give you the results you want. Furthermore, Roto-Finish guarantees to produce the same results in your plant that are achieved in sample processing.

Let Us Help You with Your Problems

Roto-Finish **COMPANY**

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For This Production Boosting

"TRICO-MIST" COOLANT SYSTEM

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IT IS EASY TO DO. IT'S THE BEST DOLLAR, YOU WILL ADMIT, YOU EVER SPENT.

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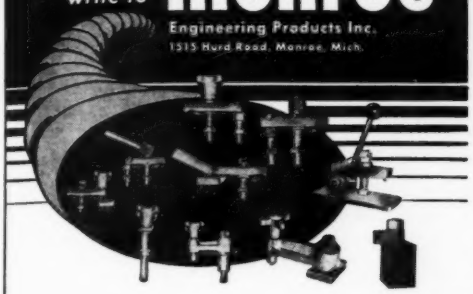
1515 Hurd Road, Monroe, Mich.



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USE THE RIGID **BOREMASTER** FREE CUTTING

Five sizes available for holes or cores fom 1½" to 11¾" and to a depth of 8".

BOREMASTER is not a Fly Cutter, but a Heavy Duty Trepanning Tool with retractable Pilot. Two blades cut simultaneously—a lead blade and finishing blade—giving good stability and chip load distribution. Stock is removed in one piece.

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Also available without pilot for turret lathes.

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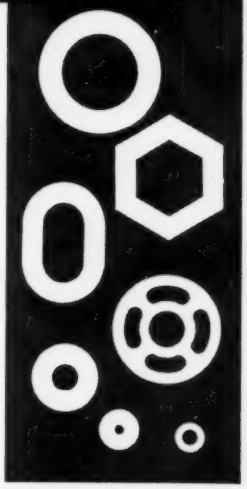
No Soldering Skill Needed

With

BONDALOY
SOLDER PREFORMS



Prefabricated to exact size and shape. Bondaloy Solder Preforms put just enough solder in just the right place.

Soldering then becomes merely a matter of applying heat. No skill is needed—the heat may be applied automatically. And every joint is perfect.

The saving in time and money is enormous, because it puts soldering on a production basis—removes from it the uncertainties of an art. Equally important is the reduction of rejects and service failures.

Same parts available in copper for production brazing.

7891

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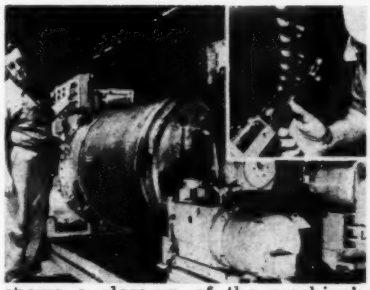
DRILLING AND MILLING REDUCED TO ONE-TENTH OF FORMER TIME

As many as 80 holes are drilled and 40 scallops are milled automatically in a jet engine tailpipe by a new drilling and milling machine.

The special machine was devised by the General Electric Company as a part of a cost reduction program, and it can perform the drilling and milling on a tailpipe in about 30 min, or approximately 1/10th of the time formerly required. Use of the machine will save thousands of dollars annually in jet engine manufacturing costs, according to company engineers. The inset view at upper right



shows a close-up of the machine's drilling apparatus.

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AUTOMATIC ELECTRONIC!
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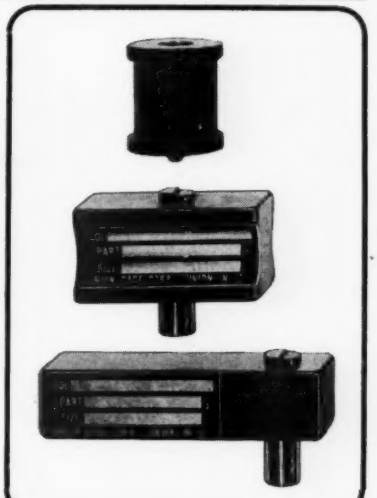

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CUMULATIVE EDITORIAL INDEX FOR 1957 ISSUES

TOOLING & PRODUCTION Magazine

The number of subjects in which T&P's editors present material in just a few issues adds up very rapidly. Most articles are of lasting interest and have future reference value in solving tooling and production problems.

This cumulative index will build up progressively during each calendar year. Each issue will carry a cumulative index of material contained in all previous issues of the same year, with each January issue carrying the complete index of the twelve issues of the previous year.

We suggest you see to it that your copies of T&P are retained for future reference so you can get the full benefit of this new, unique and useful index.

The Publisher

SUBJECT INDEX

Abrasive machining
Belt grinding of motor rotors, Jan. p. 151 (½ p)
New techniques in machining methods, Jan. p. 63 (6 pp)

Adhesives
Epoxy bonding of carbides to steel, Feb. p. 79 (5 pp)

Airfoil, machine for milling, Apr. p. 92 (1½ pp)

Air power
Air-actuated clamping blocks, Apr. p. 85 (1 p)
Air gages for measuring distance between hole centers, Sept. p. 95 (9 pp)
Circuits, safe pneumatic, self teaching methods for, July, p. 80 (4 pp)
Cylinders, 10 widely held misconceptions of, Apr. p. 132 (2/3 p)
Multiple gun drilling, air feed, May, p. 105 (3 pp)
Notebook: Tips on air equipment maintenance, Feb. p. 111 (4 pp)
Vacuum locating device for precision drilling, Sept. p. 108 (½ p)

Alloys, brazing, selection of, Aug. p. 93 (5 pp)

Apprenticeship
Dividing skilled groups, Apr. p. 114 (½ p)
Program building, Jan. p. 11 (3 pp)

Assembly
Adapters, torque wrench, for hard to reach spots, July, p. 110 (2/3 p)
Automatic, machines for, Apr. p. 89 (3 pp)
Automatic, product designing for, July, p. 16 (2-1/3 pp)
Small parts, automation for, Aug. p. 71 (1 p)

Automatic handling
Basketing workpieces, Feb. p. 119 (½ p)
Demand-feed distribution system, Jan. p. 77 (1/3 p)
Heat treating, loading gears for, July, p. 133 (1/3 p)
Product designing for, July, p. 16 (2-1/3 pp)
Shuttle transfer conveyor, Jan. p. 108 (¼ p)
Stacker for tube and bar transfer, July, p. 120 (1/3 p)
Storage unit, rotary, Apr. p. 84 (½ p)
Transfer presses, on, June, p. 87 (13½ pp)

Automation
Automated control of gear quality, May, p. 91 (6 pp)
Built-in quality control, May, p. 104 (1 p)
Capital cost of, June, p. 82 (1 p)
Color coding to simplify machine changeover, June, p. 75 (2¾ pp)
Dressing grinding wheels for, July, p. 85 (2 pp)
In-process Q-C for transfer lines, May, p. 81 (5 pp)
Magnetic memory system for, Mar. p. 219 (1/3 p)
Maintenance problems of, June, p. 82 (1 p)
Myths and fallacies of, Mar. p. 95 (4 pp)
Product designing for, July, p. 16 (2-1/3 pp)
Small parts assembly, using, Aug. p. 71 (1 p)
Standard units for, June, p. 122 (½ p)
Transfer presses for, June, p. 87 (13½ pp)

Bonuses for supervisors, Feb. p. 148 (1 p)

Boring heads, multi-diameter, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)

Boring machine, multiple spindle, June, p. 104 (1 p)

Boring tool trouble analysis, Mar. p. 99 (6 pp)

Brazing
Air clamps for, Apr. p. 85 (1 p)
Alloy selection and joint design, Aug. p. 93 (5 pp)
Fundamentals for, May, p. 99 (5 pp)
Heating source and procedures for, Sept. p. 85 (5½ pp)
Induction, ceramic jigs for, June, p. 78 (1 p)

Broaching, external, on automatic screw machine, June, p. 73 (2 pp)

Broaching machine, automated, Jan. p. 154 (½ p)

Cams engineered for their production in limited quantities, July, p. 92 (3 pp)

Carbide
Bonding with epoxy, Feb. p. 79 (5 pp)
Boring of multi-diameters, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)
Brazing, special fluxes for, Mar. p. 104 (¼ p)
Dies, hot heading titanium bolts with, Mar. p. 111 (1/3 p)
Dies produce quality parts, Feb. p. 58 (1 p)
Drilling and reaming of precision holes, July, p. 71 (4 pp)
Grades classified, Feb. p. 95 (4 pp)
Gun drilling, fixturing for, Mar. p. 79 (4 pp)
Machining hi-temp alloys with, Feb. p. 73 (6 pp)
Metallurgy, Feb. p. 95 (4 pp)
Milling with, Feb. p. 85 (4 pp)
Multiple gun drilling, May, p. 105 (3 pp)
Super-hard, for long tool life, Aug. p. 77 (4 pp)
Tipped soldering jigs, May, p. 148 (½ p)

Chemical milling, applications of, Aug. p. 98 (2-1/3 pp)

Ceramic tooling, discussion of, June, p. 100 (1½ pp)

Circuits, safe pneumatic, self teaching methods for, July, p. 80 (4 pp)

Coated abrasive machining methods, Jan. p. 63 (6 pp)

Cold forming process, Fellows-Appel, Mar. p. 78 (1 p)

Color coding to simplify machine changeover, June, p. 75 (2¾ pp)

Controls
Automation magnetic memory system, Mar. p. 219 (1/3) p
Electro-hydraulic servo system, Jan. p. 104 (½ p)
Electro-hydraulic transducer, Feb. p. 105 (5½ pp)
Numerical, for jig borers, etc. Apr. p. 80 (1 p)
Numerical, in aircraft industry, Feb. p. 48 (1½ pp)
Press "non-repeating" system, June, p. 108 (1/3 p)
Tape, for positioning table, Mar. p. 88 (1 p)
Tracer, for profile milling, Apr. p. 181 (¾ p)
Welding, Feb. p. 110 (¾ p)

Coolants
Abrasive machining, Jan. p. 67 (½ p)
Gun drilling, for, Mar. p. 79 (4 pp); May, p. 105 (3 pp)
Honed bores automatically sized with, Sept. p. 104 (1 p)
Inductor bushing for drilling copper, June, p. 79 (3 pp)
Synthetic, test report on, May, p. 180 (½ p)

Countersink, self-aligning, Jan. p. 94 (1/3 p)

Coupling, flexible, compensates for shaft misalignment, July, p. 106 (1 p)

Cutting tools
Bi-carbide, construction for, Aug. p. 77 (4 pp)
Ceramic, pros and cons of, June, p. 100 (1½ pp)
Form milling cutters, design and application of, Mar. p. 89 (3½ pp)
It's time to re-evaluate, July, p. 69 (1 p)
Multi-diameter, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)

Deburring of copper tubing, Jan. p. 78 (1 p)

Deep drawing of molybdenum anodes, June, p. 106 (2 pp)

Design of high production tools, Mar. p. 74 (4 pp)

Designing for easier machining, automatic handling and assembly, July, p. 16 (2-1/3 pp)

Diamond pins, establishing sizes of, Aug. p. 84 (2 pp)

Diamond powder cutters for dressing grinding wheels, July, p. 85 (2 pp)

Dies
Carbide, hot heading titanium bolts with, Mar. p. 111 (1/3 p)
Carbide, produce quality parts, Feb. p. 58 (1 p)
Contour sawing of, Apr. p. 100 (1 p)
Die-casting, mould coatings for, Aug. p. 91 (2 pp)
Epoxy-faced June, p. 103 (1 p)
Large, die-layout machine for, Aug. p. 76 (1 p)
Progressive, for limited run stamping, Aug. p. 89 (2 pp)
Short run, construction of, Sept. p. 81 (4 pp)

Die Sinker, equipped for deep tracing, Feb. p. 105 (5½ pp)

Drawing lubricant selection, July, p. 87 (5 pp)

Drilling
Copper, coolant inductor bushing for, June, p. 79 (3 pp)
Gun, fixturing for, Mar. p. 79 (4 pp)
Gun, multiple, air-powered, May, p. 105 (3 pp)
Machine, deep hole, Jan. p. 51 (¼ p)
Production drilling of precision holes, July, p. 71 (4 pp)
Vacuum locating device for precision drilling, Sept. p. 108 (½ p)
Variable workpieces, Jan. p. 69 (3 pp)
Wide range of bolt circle diameters, Apr. p. 109 (1/3 p)

Drill press fixture for lapping, Aug. p. 87 (1½ pp)

Drills, trepan-type, for precision holes, July, p. 71 (4 pp)

Economics, industrial
Car battle of 1958, Sept. p. 71 (1 p)
Editors look at '57, Jan. p. 61 (1 p)
Machine tool outlook for '57, Jan. p. 72 (5-2/3 pp)
Machine tool sales to hit billion dollars, Jan. p. 156 (½ p)
Obsolescence of machine tools, June, front cover, (2 pp)
Tool and die forecast for '57, Jan. p. 156 (3/5 p)

Electrolytic grinding of honeycomb, Apr. p. 185 (1/3 p)

Experimental designs, Apr. p. 119 (5 pp)

Extruding, spray lubrication for, May, p. 149 (¼ p)

Feeds for transfer presses, June, p. 87 (13½ pp)

Fixtures (see Jigs and fixtures)

Form milling cutters, design and application of, Mar. p. 89 (3½ pp)

Gages
Air-type, for automation quality control, May, p. 104 (1 p)
Maintenance of, May, p. 80 (½ p)

Gaging
Air, for measuring distance between hole centers, Sept. p. 95 (9 pp)
Air, of drill jig bushings, Apr. p. 81 (3½ pp)
Automatic, for gear dimensional accuracy, May, p. 91 (6 pp)
Electronic system for grinders, Apr. p. 174 (1/3 p)
Fixture for gaging OD of segment-shaped components, Sept. p. 91 (2½ pp)
In-process quality control equipment, May, p. 81 (5 pp)
Stampings, details of, Aug. p. 73 (3 pp)

Gears, automated control of quality production, May, p. 91 (6 pp)

Grinding and finishing
Abrasive machining methods, Jan. p. 63 (6 pp)
Belt grinding of motor rotors, Jan. p. 151 (½ p)
Cylindrical machine for large light work, Jan. p. 147 (1/3 p)

Dressing grinding wheels automatically, July, p. 85 (2 pp)
Electrolytic, of honeycomb, Apr. p. 185 (1/3 p)
Fixturing for rotary surface grinder, Apr. p. 73 (5 pp)
Grinder for heavy stock removal, June, p. 86 (1 p)
Grinding crankpins automatically, Sept. p. 90 (½ p)
Numerically controlled hole grinder, Apr. p. 80 (1 p)
Precision, of servo valve components, Apr. p. 88 (1 p)
Surface grinder for large dies, July, p. 117 (1 p)
Tool post grinders, versatility of, July, p. 84 (1 p)

Grinding, tool
Form milling cutters, Mar. p. 89 (3½ pp)

Gun drilling
Fixturing for, Mar. p. 79 (4 pp)
Multiple, air-powered, May, p. 105 (3 pp)

Heat treating
Automatically loading gears for, July, p. 133 (1/3 p)
Critical quenching speed, Mar. p. 74 (4 pp)
Rapid quenching with reduced distortion, Jan. p. 78 (3½ pp)
Stainless steel for honeycomb structures, Sept. p. 73 (8 pp)

Honing, bores automatically sized by, Sept. p. 104 (1 p)

Hydraulics
Cylinders, 10 widely held misconceptions of, Apr. p. 132 (2/3 p)

Inspection
Distance between hole centers, measurement of, Sept. p. 95 (9 pp)
100%, on small motors, May, p. 87 (3½ pp)
Tools, of, May, p. 18 (1½ pp)

Interferometer-digital counter measuring system, Mar. p. 83 (4½ pp)

Inventory
In-process, shrinkage of, May, p. 116 (1½ pp)
Management principles, Jan. p. 83 (4 pp; 12 pp in Nov. and Dec. '56 issues)

Jigs and fixtures
Boring and turning, work holding rules for, July, p. 75 (4 pp)
Drill jig centers variable workpieces, Jan. p. 69 (3 pp)
Fixtures, air, for silver brazing,
Fixtures for band saw cutting, Sept. p. 122 (2 pp)
Apr. p. 85 (1 p)
Fixture for drill press lapping,
Fixture for gaging OD of segment-shaped components, Sept. p. 91 (2½ pp)
Aug. p. 87 (1½ pp)
Fixtures for gun drilling, Mar. p. 79 (4 pp)
Fixtures for surface grinding, Apr. p. 73 (5 pp)
Jigs, ceramic, aid to brazing, June, p. 78 (1 p)
Plastic, for short runs, Feb. p. 182 (¾ p)
Tool steels for high production, Mar. p. 74 (4 pp)

Lathe
Center drive, tracing, for contouring, Aug. p. 86 (1½ pp)
Turret, tooling for valve parts, Apr. p. 86 (2 pp)
Vertical chucking, May, p. 252 (1 p)

Lubricant
Castor oil, for deep drawing molybdenum, June, p. 106 (2 pp)
Drawing, selection for, July, p. 87 (5 pp)
Fire-safe for air compressors, Sept. p. 134 (½ p)
Spray, for extruding, May, p. 149 (¼ p)

Machine tool industry
Machine tool sales to hit billion, Jan. p. 156 (½ p)
Obsolescence, June, front cover (2 pp)
Outlook for '57 by industry leaders, Jan. p. 72 (5-2/3 pp)

Machining (also see specific process)
Abrasive, belt grinding of motor rotors, Jan. p. 151 (½ p)
Abrasive, new techniques in machining methods, Jan. p. 63 (6 pp)
Chemical milling process for, Aug. p. 98 (2-1/3 pp)
Contouring jet discs, Aug. p. 86 (1½ pp)
Contour sawing large workpieces, Apr. p. 100 (1 p)
Cost cutting with band saw, Sept. p. 122 (2 pp)
High temperature alloys with carbides, Feb. p. 73 (6 pp)
Hydraulic valves, machining and testing of, Apr. p. 101 (4 pp)
Motor load measurement detects trouble, Sept. p. 94 (1 p)
Product designing for, July, p. 16 (2-1/3 pp)
Profile milling jet engine blades, Sept. p. 118 (2/3 p)
Profiling, numerically controlled, Feb. p. 48 (1½ pp)
Spark erosion process, May, p. 164 (½ p)
Titanium, a case history of, June, p. 83 (3 pp)
Tracing without templates, Feb. p. 105 (5½ pp)
Turning and boring, work holding rules for, July, p. 75 (4 pp)

Maintenance
Automation, problems of, June, p. 82 (1 p)
Gages, May, p. 80 (½ p)
Management for small plants, Apr. p. 9 (2¼ pp)
Preventive, Feb. p. 120 (1-1/3 pp)

Management
Bonuses for supervisors, Feb. p. 148 (1 p)
Industry-education programs, organizing for, Sept. p. 57 (2-2/3 pp)
Mathematical programming for, Apr. p. 94 (6 pp)
Overtime costs, questions and answers for, Sept. p. 112 2 pp)
Preventive maintenance records, Feb. p. 120 (1-1/3 pp)
Quality assurance and reliability, Mar. p. 12 (2¼ pp)
Role and responsibility in safety programs, Apr. p. 110 (2/3 p)
Safety economics in stamping plants, June, p. 114 (2¼ pp)
Scheduling engineers' activities, Feb. p. 173 (½ p)
The million-dollar lathe, May, p. 77 (1 p)
Time study of punch-press operations, Feb. p. 99 (6 pp)
Training for quality control, May, p. 97 (2¼ pp)

Manpower shortage, 20 ways to ease, Apr. p. 78 (2 pp)

Mathematical programming, a short cut to, Apr. p. 94 (6 pp)

Measurement methods
Distance between hole centers, measurement of, Sept. p. 95 (9 pp)
Fringecount micrometer, Mar. p. 83 (4½ pp)

Methods-time measurement, Feb. p. 99 (6 pp)

Milling
Cutters, form, design and application of, Mar. p. 89 (3½ pp)
Head, hydraulic, Feb. p. 116 (1 p)
Profile, tracer controlled, Apr. p. 181 (¾ p)
Shaping giant airfoils and complex parts, Apr. p. 92 (1½ pp)
With carbides, Feb. p. 85 (4 pp)

Molybdenum anodes, deep drawing of, June, p. 106 (2 pp)

Mould coatings, function and selection of, Aug. p. 91 (2 pp)

Obsolescence of machine tools, June, front cover (2 pp)

Optical measuring system, Mar. p. 83 (4½ pp)

Patent Suits, Mar. p. 110 (1 p)

Personnel management
Bonuses for supervisors, Feb. p. 148 (1 p)
Departmental loan of workers, Aug. p. 81 (3 pp)
Foreman selection, Mar. p. 57 (1 p); Apr. p. 148 (1-1/3 pp); May, p. 58 (1 p)
Foreman selection, evaluation contamination in, June, p. 57 (1 p); July, p. 48 (1-1/3 pp)
Foreman selection, minimizing evaluation deficiencies for, Sept. p. 15 (1-1/3 pp)
Hiring new employees, Feb. p. 14 (1 p)
Performance evaluation and foreman selection, May, p. 58 (1 p)
Selection testing, Jan. p. 46 (2/3 p)
Supervisor selection, evaluation for, Aug. p. 52 (1-1/3 pp)

Pins, diamond, establishing sizes of, Aug. p. 84 (2 pp)

Plastic tooling
Epoxy-faced die, June, p. 103 (1 p)
Short run operations, Feb. p. 182 (¾ p)

Pneumatic (see Air Power)

Presses
Automatic for limited run stamping, Aug. p. 89 (2 pp)
Die change pushbutton controlled, Aug. p. 107 (½ p)
Function of lubricant in press drawing, July, p. 87 (5 pp)
"Non-repeating" safety system, Jan. p. 108 (1/3 p)
Pre-set dies for short run production, Aug. p. 114 (½ p)
Productivity, true measurement of, May, p. 116 (1½ pp)
Punch, time study of operations, Feb. p. 99 (6 pp)
Transfer, for automation, June, p. 87 (13½ pp)

Preventive maintenance, usable records, Feb. p. 120 (1-1/3 pp)

Production and inventory control society formed (APICS), Apr. p. 113 (1/3 p)

Production data automatically recorded, Mar. p. 93 (1¾ pp)

Profile sharpening of milling cutters, Mar. p. 89 (3½ pp)

Quality Control
Assurance and reliability, Mar. p. 12 (2¼ pp)
Automated gear production with, May, p. 91 (6 pp)
Built into automation lines, May, p. 104 (1 p)
Control of surface quality and geometry, May, p. 108 (4 pp)
Peg-board Q-C, May, p. 78 (2½ pp)
Prove it, May, p. 114 (½ p)
Reliability, evolution of, Mar. p. 73 (1 p)
Semi and final assembling small motors by, May, p. 87 (3½ pp)
Tool proofing: a means of, May, p. 18 (1½ pp)
Training for, May, p. 97 (2¼ pp)
Transfer-type special machine tools with, May, p. 81 (5 pp)
TV system assists spotwelding control, Sept. p. 120 (½ p)
Zero center method of, May, p. 78 (2½ pp)

Quenching with reduced distortion, Jan. p. 78 (3½ pp)

Reamers, trepan-type, for precision holes, July, p. 71 (4 pp)

Recorder, automatic, of production data, Mar. p. 93 (1¾ pp)

Safety
Does not cost money: it pays money, June, p. 114 (2¼ pp)
Holding employee interest in, Jan. p. 140 (1¼ pp)
Investigating and reporting of industrial accidents, June, p. 102 (2/3 p)
Job safety, analysis of, Aug. p. 100 (2/3 p)
Programs, management's role and responsibility in, Apr. p. 110 (2/3 p)

Scrap disposal, automatic, Jan. p. 149 (½ p)

Screw-machine
Automatic, external broaching on, June, p. 73 (2 pp)
High speed, holds limits to 0.0005", Apr. p. 93 (1 p)
Plunge thread rolling on, May, p. 86 (1 p)

Small plants, maintenance management of, Apr. p. 9 (2¼ pp)

Soldering, automatically, of fuel-tank filler necks, Aug. p. 106 (1½ pp)

Special machines (also see "Automation")
Automatic, for soldering, Aug. p. 106 (1½ pp)
Automatic, from standard units, Apr. p. 89 (3 pp)
Profile milling jet engine blades, Sept. p. 118 (2/3 p)

Stampings
Gaging of, Aug. p. 73 (3 pp)
Limited run, press and die for, Aug. p. 89 (2 pp)

Standard units for
Automatic machines, June, p. 122 (½ p)
Automatic special machines, Apr. p. 89 (3 pp)
Versatile boring machine, June, p. 104 (1 p)

Steel
Stainless, for honeycomb structures, Sept. p. 73 (8 pp)
Standards, guide to specifying, Feb. p. 126 (1-2/3 pp)
Tool, proper selection of, Mar. p. 74 (4 pp)

Surface quality and geometry, laboratory control of, May, p. 108 (4 pp)

Tape, for positioning table, Mar. p. 88 (1 p)

Titanium, production machining of, June, p. 83 (3 pp)

Tool design and fabrication, Mar. p. 74 (4 pp)

Tools, inspection of, May, p. 18 (1½ pp)

Training, for quality control, May, p. 97 (2¼ pp)

Transfer machine handles 36 different parts, June, p. 75 (2¾ pp)

Transfer presses for automation, June, p. 87 (13½ pp)

Tubing, deburring of copper, Jan. p. 78 (1 p)

TV for die-layout machine, Aug. p. 76 (1 p)

Welding
Automatic arc, Jan. p. 82 (½ p)
Controls, Feb. p. 110 (¾ p)
Machine automated for welding, assembling, machining, testing, July, p. 128 (1/3 p)
Spatter problem solved, Feb. p. 118 (1 p)
Spot, TV system assists control of, Sept. p. 120 (½ p)

Wheel dressing process, grinding, July, p. 85 (2 pp)

Work holding rules for turning and boring, July, p. 75 (4 pp)

FOR ADDITIONAL INFORMATION REGARDING PRODUCTS ADVERTISED OR EDITORIAL ARTICLES PLEASE FILL OUT AND MAIL THE INFORM-A-GRAM CARD ON PAGE 170.1. ANY COMMENTS REGARDING THIS BOOK WILL ALSO BE APPRECIATED.

ADVERTISERS' INDEX

A.I.T. Diamond Tool Co. 228
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Acme Industrial Co. 68
Acme Tool Co. 263
Acro Metal Stamping Co. 220
Advance Products Corp. 166
Aget Mfg. Co. 249
Alina Corp. 245
Allegheny Ludlum Steel Corp. 171
Allen, Alva F. 227
Allied Products Corp., Richard Brothers Punch Div. 181
Aloris Tool Co., Inc. 214
American Drill Bushings Co. 10
American Positive Grip Vise Corp. 200
American Pullmax Co., Inc. 134
Ames Co., B. C. 150
Ampco Metal, Inc. 165
Anocut Engineering Co. 217
Applied Mechanics Corp. 235
Armstrong-Blum Mfg. Co. 198
Armstrong Bros. Tool Co. 225
Arrow Tool & Reamer Co. 268
Arrow Tools, Inc. 254
Assembly Poducts, Inc. 262
Atlas Press Co., Clausing Div. 127
Avildsen Tools & Machines, Inc. 207

Balas Collet Mfg. Co. 7
Ball Machinery Co. 124
Barber-Colman Co. 24
Barber-Colman Co., Hendey Machine Div. 26
Bausch & Lomb Optical Co. 157
Bay State Abrasive Products Co. 277
Bellows Co., The 37
Bischoff Chemical Corp. 232
Black Drill Co., Inc. 241
Blake Co., Inc. 210
Blanchard Machine Co., The 35
Bliss Co., E. W. 184, 254
Boyar-Schultz Corp. 129
Branch Mfg. Co. 236
Brandes Press Co., The 136
Brown & Sharpe Mfg. Co. 50
Bryant Chucking Grinder Co. 199
Buck Tool Co. 208
Bullard Co., The 125
Bushman Co., H. L. 195

Casalbi Co., Globe Barrel Finishing Equipment Div. 218
Central Safety Equipment Co. 261
Certif-A-Gift Co. 245
Challenge Machinery Co., The 135
Chandler Tool Co. 232
Chicago Tool & Engrg. Co. 246
Cincinnati Milling Machine Co., The 113
Clark Co., Robert H. 214
Clausing Div., Atlas Press Co. 127
Cleveland Crane & Engrg. Co., The 28
Cleveland Punch & Shear Works Co. 119
Cleveland Twist Drill Co. 151
Commander Mfg. Co. 261
Comtor Co. 265
Cone Automatic Machine Co. 56
Continental Tool Works, Div. Ex-Cell-O Corp. 186, 194
Cook, Inc., Lawrence H. 235
Cooper Weymouth, Inc. 269
Covel Mfg. Co. 52
Crucible Steel Co. of America 8, 51
Cullen Mfg. Co. 253

Dalzen Mfg. Co. 131
Danly Machine Specialties, Inc. 34
Darwin & Milner, Inc. 149
Dayton Rogers Mfg. Co. 195, 249
Dearborn Gage Co. 160
Defiance Machine & Tool Co. 187
Derbyshire, Inc., F. W. 265
Detroit Die Set Corp. 30
Detroit Stamping Co. 245, 261
Detroit Testing Machine Co. 227
Detterbeck Co., The George L. 192
DeVlieg Machine Co. 55
Dice Co., J. W. 271
Dickerman Mfg. Co., H. E. 252
Die Supply Div. of E. W. Bliss Co. 117
DoAll Co., The 145
Donley's Sons, Ernest F. 195
Dremel Mfg. Co., ...275
Drillmation Co. 217
Dumore Co., The 33, 154
Durant Tool Supply Co. 253
Dykem Co., The 250

Economy Engineering Co. 214
Economy Tool & Machine Co. 224
Edlund Machinery Co. 169
Eisler Engineering Co., Inc. 275
Engis Equipment Co. 189
Erickson Tool Co. 70
Ettco Tool Co. 207
Ex-Cell-O Corp., Continental Tool Works Div. 186, 194

Federal Press Co., The 9
Federal Products Corp. 243
Federal Tool & Mfg. Co. 202
Federal Tool Corp. 266
Feedall, Inc. 246
Fellows Gear Shaper Co., The 140
Fenn Mfg. Co. 175
Field Tool Supply Co. 139
Fonda Gage Co., D. C. 192
Ford Mfg. Co., Inc., M. A. 227
Foster Supplies Co. 228

Gaertner Scientific Corp., The 224
Gage Co. 241
Gardner-Denver Co., Keller Tool Div. 18
Gardner Machine Co. 218
Gas Appliance Service, Inc. 270
Gatco Rotary Bushing Co. 232
Gay-Lee Co. 232

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Gorton Machine Co., George 176
Graphic Systems 250
Graymills Corp. 233
Greenfield Tap & Die Corp. 137
Greenleaf Corp. (Newcomer Products, Inc.) 143
Greenlee Brothers & Co. 177
Gridley Machine Div'n., New Britain Machine Co. 39
Grip Nut Co. 254

Hamilton Tool Co., The 22, 183, 185
Hanchett Magna-Lock Corp. 152
Hannifin Corp. 210, 224
Hardinge Brothers, Inc. 3
Haskins Co., R. G. 237
Heimann Mfg. Co. 235
Heinrich Tools, Inc. 182
Hendey Machine Div., Barber-Colman Co. 26
High Standard Mfg. Co. 218
Hill Acme Co. 241
Horton Chuck Div., Greenfield Tap & Die Corp. 138
Hovis Screwlock Co. 211
Huebner Publications, Inc. 206, 256, 276
Huppert Co., K. H. 267
Hutchinson Co., William T. 31

Index Machine Co. 216
Industrial Tectonics, Inc. 214
Ingersoll-Rand Co. 58, 59

Jaco Devices, Inc. 199, 250, 275
Jansson Gage Co. 223
Jarke Mfg. Co. 223
Jergens Tool Specialty Co. 188
Jersey Mfg. Co. 235
Johnson & Bassett, Inc. 253
Johnson Gas Appliance Co. 195
Jones & Lamson Machine Co. 36
Kalamazoo Tank & Silo Co. 242
Kearney & Trecker Corp., Special Machinery Div. 172
Kennametal, Inc. 32
Kidde Precision Tool Corp. 217, 223

Lakeside Steel Improvement Co., The 276
Lamina Dies & Tools, Inc. 72
Lapeer Mfg. Co. 236
Lavalee & Ide, Inc. 4
Laystrom Mfg. Co. 42
Lee Co., K. O. 115, 188
Levin & Son, Inc., Louis 188
Lewis Machine Co., The 121
Lincoln Gage Co. 190
Logan Engineering Co. 193
Lovejoy Tool Co., Inc. 235

Madison-Kipp Corp. 249
Magna Driver Corp. 262
Magnetic Tool Corp. 276
Marx Co., Clarence J. 241
McCrosky Tool Corp. 244
Mead Specialties Co. 269
Metal Carbides Corp. 12
Metallurgical Products Dept. of General Electric 167
Mettler Machine Tool, Inc. 168
Meyers Co., Inc., W. 236
Michigan Chrome & Chemical Co. 209
Michigan Tool Co. 251
Miller Fluid Power Div., Flick Reedy Corp. 239
Mohawk Tools, Inc. 61
Moline Tool Co. 54
Monroe Engrg. Products, Inc. 271
Moore Special Tool Co., Inc. 180
Motch & Merryweather Machinery Co., Inc., The 45

National Acme Co., The 29
National Tool Salvage Co. 196
Neise, Karl A. 196, 223, 253, 264, 271
New Britain Machine Co. Gridley Machine Div. 39
Newcomer Products, Inc. (Greenleaf Corp.) 143
Niagara Machine & Tool Works 20
Nicholson File Co. 221
Nilson Machine Co., A. H. 158
Norton Co. 203

Ohio Knife Co., The 196
Olkon Research Corp. 64
O'Neil-Irwin Mfg. Co. 60
Onsrud Machine Works, Inc. 226
Ortman-Miller Machine Co. 66

Parker-Majestic, Inc. 44
Perkins Machine Co. 230
Perkins Machine & Gear Co. 207
Petz-Emery, Inc. 218
Pivot Punch & Die Corp. 248
Portage Machine Co., The 123
Porter Precision Products 162
Pratt & Whitney Co., Inc. 47, 48, 49
Precision-Detroit Co. 69
Precison Tool Mfg. Co. of Ill. 275
Preis Engraving Machine, H. P. 195
Presswork, Incorporated 271
Procunier Safety Chuck Co. 242
Production Devices, Inc. 196
Production Feeder Corp. 267
Producto Machine Co. 174, 209, 250
Punch Products Co. 156
Putnam Tool Co. 278

R. B. Tool Co., Inc. 266
Rahn Granite Surface Plate Co. 263
Reid Brothers Co., Inc. 65
Reid Tool Supply Co. 202
Rice Pump & Machine Co. 200
Richard Brothers Punch Div., Allied Products Corp. 181
Richards Co., J. A. 202
Ring Punch & Die Co. 209
Rockwell Mfg. Co., Delta Power Tool Div. 13
Roto-Finish Co. 270
Royal Oak Tool & Machine Co. 201
Royal Products 253

Sales Service Machine Tool 247
Scherr Co., Inc., George 250, 261
Scully-Jones & Co. 142
Sentry Co., The 264

Service Machine Co. 202
Sheffield Corp., The 14
Sheldon Machine Co., Inc. 234
Shell Chemical Corp. 23
Shore Instrument & Mfg. Co., Inc. 223
Silber Products, Inc. 235
Skinner Chuck Co. 132
Small Lot Stamping Co. 209
South Bend Lathe Works 231
Spellman Co., R. L. 188
Sperry Products, Inc. 242, 265
Spiral Step Tool Co. 236
Standard Die Set Mfgrs., Inc. 155
Standard Parts Co. 170
Standard Pressed Steel Co. 67, 130
Star Stainless Screw Co. 266
Stebar Co. 199
Steel City Testing Machines, Inc. 173
Stewart-Warner Cop. 231
Sturtevant Co., P. A. 231
Superior Steel Products Corp. 159

Tannewitz Works, The 192
Techno Products Corp. 246
Teeter, C. B. 210
Testo Mfg. Co. 270
Thompson & Son Co., The Henry G. 163
Thompson Industries, Inc. 43
Thor Power Tool Co. 53
Threadwell Tap & Die Co. 133
Timken Roller Bearing Co., Steel & Tube Div. 16
Tomco Products Co. 253
Tomkins-Johnson Co. 215
Trico Fuse Mfg. Co. 270
True-Trace Sales Corp. 205
Tru-Seal Division, Flick-Reedy Corp. 187
Turchan Follower Machine Co. 148

Union Gage Corp. 271
United States Diamond Wheel Co. 235
United States Drill Head Co. 228
U. S. Tool Co., Inc. 62
Universal Engineering Co. 41, 238

Valvair Corp. 153
Vascoloy-Ramet Corp. 5
Vernon Devices, Inc. 267
Verson Allsteel Press Co. 229
Viking Tool Co. 206
Vlier Engineering, Inc. 6, 63
Vulcan Tool Co. 187

Wales-Strippit Corp. 17
Walls Sales Corp. 199
Wardwell Mfg. Co., The 191
Warner & Swasey Co. 161
Waterbury Farrel Foundry & Machine Co. 2
Watts Brothers Tool Works 217
Weldon Tool Co. 19
Wheelock, Lovejoy & Co., Inc. 57
Whistler & Sons, Inc., S. B. 269
Whitney Metal Tool Co. 262
Wickman Mfg. Co. 197
Willey's Carbide Tool Co. 255
Wisconsin Drill Head Co. 219
W L S Stamping Co. 242
Woodson Tool Co. 199
Woodworth, N. A. 200
Wright Tool Company 267

Yoder Co., The 38
Yost Mfg. Co. 192

Zagar Tool, Inc. 164

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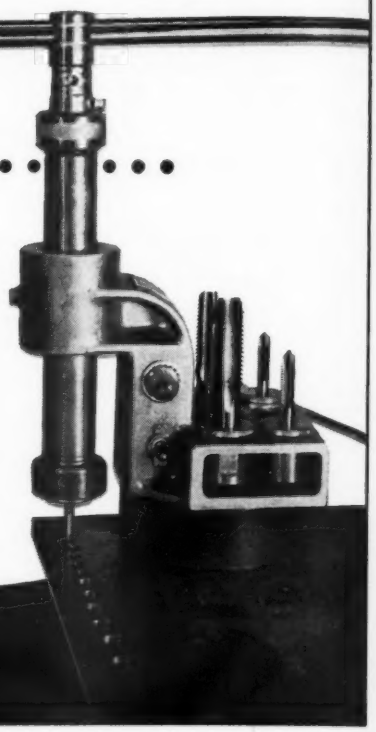

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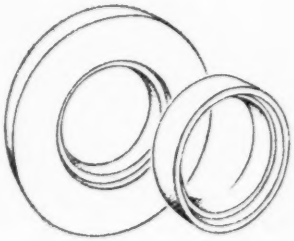

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